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**STAR**

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Space Administration  
**Langley Research Center**

**Scientific and Technical  
Information Program Office**

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# Introduction

*Scientific and Technical Aerospace Reports (STAR)* is an electronic abstract journal, listing citations with abstracts for aerospace-related reports obtained from worldwide sources. It is electronically published biweekly and announces documents that have recently been entered into the NASA Scientific and Technical Information (STI) Database. The documents are of the following types:

- NASA, NASA contractor, and NASA grantee reports;
- Reports issued by other U.S. Government agencies, domestic and foreign institutions, universities, and private firms;
- Translations in report form;
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses.

Also included are two indexes, Subject Term and Personal Author. The Subject Term Index is generated from the *NASA Thesaurus* terms associated and listed with each document.

*STAR* subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

Abstracts in *STAR* are categorized by 10 major subject divisions that are divided further into 76 specific subject categories. The subject divisions and categories are listed in the Table of Contents together with a note for each that defines its scope and provides any cross-references.

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Document citations are grouped first by the following divisions. Select a division title to view the category-level Table of Contents.

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| <a href="#">B. Astronautics</a>                       | <a href="#">I. Social and Information Sciences</a> |
| <a href="#">C. Chemistry and Materials</a>            | <a href="#">J. Space Sciences</a>                  |
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| <a href="#">F. Life Sciences</a>                      |  |
| <a href="#">G. Mathematical and Computer Sciences</a> |  |

## Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for searching on *NASA Thesaurus* subject terms and personal author names.

[Subject Term Index](#)

[Personal Author Index](#)

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## Subject Categories of the Division A. Aeronautics

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

- |  |   |           |
|--|---|-----------|
| <b>02</b>  | <b>Aerodynamics</b>                             | <b>1</b>  |
| <p>Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also <i>34 Fluid Mechanics and Heat Transfer</i>.</p>  |   |           |
| <b>03</b>  | <b>Air Transportation and Safety</b>            | <b>3</b>  |
| <p>Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in <i>09 Research and Support Facilities (Air)</i>. Air traffic control is covered in <i>04 Aircraft Communications and Navigation</i>. For related information see also <i>16 Space Transportation and Safety</i>; and <i>85 Technology Utilization and Surface Transportation</i>.</p> |   |           |
| <b>04</b>  | <b>Aircraft Communications and Navigation</b>   | <b>5</b>  |
| <p>Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also <i>06 Avionics and Aircraft Instrumentation</i>; <i>17 Space Communications</i>; <i>Spacecraft Communications, Command and Tracking</i>, and <i>32 Communications and Radar</i>.</p>  |   |           |
| <b>05</b>  | <b>Aircraft Design, Testing and Performance</b> | <b>6</b>  |
| <p>Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also <i>18 Spacecraft Design, Testing and Performance</i> and <i>39 Structural Mechanics</i>. For land transportation vehicles, see <i>85 Technology Utilization and Surface Transportation</i>.</p>  |   |           |
| <b>06</b>  | <b>Avionics and Aircraft Instrumentation</b>    | <b>10</b> |
| <p>Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also <i>04 Aircraft Communications and Navigation</i>; <i>08 Aircraft Stability and Control</i>; <i>19 Spacecraft Instrumentation and Astrionics</i>; and <i>35 Instrumentation and Photography</i>.</p>   |   |           |
| <b>07</b>  | <b>Aircraft Propulsion and Power</b>            | <b>11</b> |
| <p>Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also <i>20 Spacecraft Propulsion and Power</i>, <i>28 Propellants and Fuels</i>, and <i>44 Energy Production and Conversion</i>.</p>  |   |           |
| <b>08</b>  | <b>Aircraft Stability and Control</b>           | <b>12</b> |
| <p>Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also <i>05 Aircraft Design, Testing and Performance</i> and <i>06 Avionics and Aircraft Instrumentation</i>.</p>   |   |           |

- 09 Research and Support Facilities (Air) 13**  
Includes airports, runways, hangers, and aircraft repair and overhaul facilities, wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operation see *03 Air Transportation and Safety*. For astronomical facilities see *14 Ground Support Systems and Facilities (Space)*.

## Subject Categories of the Division B. Astronautics

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

- 12 Astronautics (General) 14**  
Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration, see *91 Lunar and Planetary Science and Exploration*.
- 14 Ground Support Systems and Facilities (Space) 14**  
Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.
- 15 Launch Vehicles and Launch Operations 15**  
Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing, and Performance*; and *20 Spacecraft Propulsion and Power*.
- 16 Space Transportation and Safety 15**  
Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information, see also *03 Air Transportation and Safety* and *15 Launch Vehicles and Launch Vehicles*, and *18 Spacecraft Design, Testing and Performance*. For space suits, see *54 Man/System Technology and Life Support*.
- 17 Space Communications, Spacecraft Communications, Command and Tracking 16**  
Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information, see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar*.

- 18    Spacecraft Design, Testing and Performance    17**  
Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems, see *54 Man/System Technology and Life Support*. For related information, see also *05 Aircraft Design, Testing and Performance*, *39 Structural Mechanics*, and *16 Space Transportation and Safety*.
- 19    Spacecraft Instrumentation and Astrionics    19**  
Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information, see also *06 Aircraft Instrumentation and Avionics*; For spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; For spaceborne telescopes and other astronomical instruments see *89 Astronomy, Instrumentation and Photography*; For spaceborne telescopes and other astronomical instruments see *89 Astronomy*.
- 20    Spacecraft Propulsion and Power    20**  
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information, see also *07 Aircraft Propulsion and Power*; *28 Propellants and Fuels*; *15 Launch Vehicles and Launch Operations*; and *44 Energy Production and Conversion*.

## Subject Categories of the Division C. Chemistry and Materials

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

- 23    Chemistry and Materials (General)    21**  
Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 24 through 29*. For astrochemistry see category *90 Astrophysics*.
- 24    Composite Materials    23**  
Includes physical, chemical, and mechanical properties of laminates and other composite materials.
- 25    Inorganic, Organic, and Physical Chemistry    25**  
Includes the analysis, synthesis, and use inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see also *34 Fluid Dynamics and Thermodynamics*, *For astrochemistry see category 90 Astrophysics*.
- 26    Metals and Metallic Materials    31**  
Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

- 27 Nonmetallic Materials 31**  
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.
- 28 Propellants and Fuels 35**  
Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.
- 29 Space Processing 36**  
Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

## Subject Categories of the Division D. Engineering

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

- 31 Engineering (General) 37**  
Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.
- 32 Communications and Radar 38**  
Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also *04 Aircraft Communications and Navigation*; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue see *03 Air Transportation and Safety*, and *16 Space Transportation and Safety*.
- 33 Electronics and Electrical Engineering 43**  
Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment. and microelectronics and integrated circuitry. For related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.
- 34 Fluid Mechanics and Thermodynamics 50**  
Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

- 35 Instrumentation and Photography 56**  
Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation*.
- 36 Lasers and Masers 63**  
Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.
- 37 Mechanical Engineering 64**  
Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.
- 38 Quality Assurance and Reliability 65**  
Includes approaches to, and methods for reliability analysis and control, inspection, maintainability, and standardization.
- 39 Structural Mechanics 65**  
Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

## Subject Categories of the Division E. Geosciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

- 42 Geosciences (General) 67**  
Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.
- 43 Earth Resources and Remote Sensing 67**  
Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis or remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photographs. For instrumentation see *35 Instrumentation and Photography*.

- 44 Energy Production and Conversion 69**  
Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.
- 45 Environment Pollution 74**  
Includes atmospheric, water, soil, noise, and thermal pollution.
- 46 Geophysics 79**  
Includes earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.
- 47 Meteorology and Climatology 85**  
Includes weather observation forecasting and modification.

## Subject Categories of the Division F. Life Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

- 51 Life Sciences (General) 95**  
Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.
- 52 Aerospace Medicine 111**  
Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.
- 53 Behavioral Sciences 119**  
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.
- 54 Man/System Technology and Life Support 123**  
Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also *16 Space Transportation* and *52 Aerospace Medicine*.

- 55 Exobiology 125**  
Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Science*.

## **Subject Categories of the Division G. Mathematical and Computer Sciences**

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

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- 61 Computer Programming and Software 130**  
Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.
- 62 Computer Systems 144**  
Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.
- 63 Cybernetics, Artificial Intelligence and Robotics 148**  
Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.
- 64 Numerical Analysis 151**  
Includes iteration, differential and difference equations, and numerical approximation.
- 65 Statistics and Probability 154**  
Includes data sampling and smoothing; Monte Carlo method; time series and analysis; and stochastic processes.

- 66 Systems Analysis and Operations Research 156**  
Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

## Subject Categories of the Division H. Physics

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

- 70 Physics (General) 157**  
Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics or solar physics see *46 Geophysics*, *90 Astrophysics*, or *92 Solar Physics*.
- 71 Acoustics 161**  
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- 72 Atomic and Molecular Physics 163**  
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- 73 Nuclear Physics 165**  
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- 74 Optics 167**  
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- 75 Plasma Physics 169**  
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- 76 Solid-State Physics 170**  
Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.
- 77 Physics of Elementary Particles and Fields 173**  
Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics*, *73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

## Subject Categories of the Division I. Social and Information Sciences

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- |           |   |            |
|-----------|---|------------|
| <b>80</b> | <b>Social and Information Sciences (General)</b>  | <b>173</b> |
|           | Includes general research topics related to sociology; educational programs and curricula.  |            |
| <b>81</b> | <b>Administration and Management</b>  | <b>174</b> |
|           | Includes management planning and research.  |            |
| <b>82</b> | <b>Documentation and Information Science</b>  | <b>175</b> |
|           | Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see <i>61 Computer Programming and Software</i> . |            |
| <b>84</b> | <b>Law, Political Science and Space Policy</b>  | <b>180</b> |
|           | Includes aviation law; space law and policy; international law; international cooperation; and patent policy.   |            |

## Subject Categories of the Division J. Space Sciences

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- |           |   |            |
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| <b>89</b> | <b>Astronomy</b>  | <b>180</b> |
|           | Includes observations of celestial bodies, astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.   |            |
| <b>90</b> | <b>Astrophysics</b>   | <b>184</b> |
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|           | Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see <i>18 Spacecraft Design, Testing and Performance</i> . |            |
| <b>92</b> | <b>Solar Physics</b>  | <b>195</b> |
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## **93    Space Radiation**

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Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *52 Aerospace Medicine*. For theory see *73 Nuclear Physics*.

## **Subject Categories of the Division K. General**

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

## **99    General**

**200**

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

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- ❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
- ❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
- ❹ Mar. 1996; 130p; In English
- ❺ Contract(s)/Grant(s): RTOP 505-68-70-04
- ❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
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To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❽ Author
- ❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

*A Biweekly Publication of the National Aeronautics and Space Administration*

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VOLUME 40, MAY 3, 2002

## 02 AERODYNAMICS

*Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also 34 Fluid Mechanics and Heat Transfer.*

**20020039533** NASA Ames Research Center, Moffett Field, CA USA

### **Control of Flow Separation Using Adaptive Airfoils**

Chandrasekhara, M. S., Naval Postgraduate School, USA; Wilder, M. C., Naval Postgraduate School, USA; Carr, L. W., NASA Ames Research Center, USA; [1996]; 16p; In English; AIAA 35th Aerospace Sciences Meeting, 6-9 Jan. 1997, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

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A novel way of controlling flow separation is reported. The approach involves using an adaptive airfoil geometry that changes its leading edge shape to adjust to the instantaneous flow at high angles of attack such that the flow over it remains attached. In particular, a baseline NACA 0012 airfoil, whose leading edge curvature could be changed dynamically by 400% was tested under quasi-steady compressible flow conditions. A mechanical drive system was used to produce a rounded leading edge to reduce the strong local flow acceleration around its nose and thus reduce the strong adverse pressure gradient that follows such a rapid acceleration. Tests in steady flow showed that at  $M = 0.3$ , the flow separated at about 14 deg. angle of attack for the NACA 0012 profile but could be kept attached up to an angle of about 18 deg by changing the nose curvature. No significant hysteresis effects were observed; the flow could be made to reattach from its separated state at high angles by changing the leading edge curvature.

Derived from text

*Airfoil Profiles; Boundary Layer Separation; Compressible Flow; Steady Flow; Hysteresis*

**20020039700** Naval Postgraduate School, Dept. of Aeronautics and Astronautics, Monterey, CA USA

### **Development of High Speed Imaging and Analysis Techniques Compressible Dynamics Stall**

Chandrasekhara, M. S., Naval Postgraduate School, USA; Carr, L. W., Army Aviation Research, Development and Engineering Center, USA; Wilder, M. C., Naval Postgraduate School, USA; [1996]; 13p; In English; AGARD 81st Fluid Dynamics Panel Symposium on Advanced Aerodynamic Measurement Technology, 22-25 Sep. 1997, Washington, DC, USA; Sponsored by Advisory Group for Aerospace Research and Development, Unknown

Contract(s)/Grant(s): RTOP 522-31-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Dynamic stall has limited the flight envelope of helicopters for many years. The problem has been studied in the laboratory as well as in flight, but most research, even in the laboratory, has been restricted to surface measurement techniques such as pressure transducers or skin friction gauges, except at low speed. From this research, it became apparent that flow visualization tests performed at Mach numbers representing actual flight conditions were needed if the complex physics associated with dynamic stall was to be properly understood. However, visualization of the flow field during compressible conditions required carefully aligned and meticulously reconstructed holographic interferometry. As part of a long-range effort focused on exposing of the physics of compressible dynamic stall, a research wind tunnel was developed at NASA Ames Research Center which permits visual access to the full flow field surrounding an oscillating airfoil during compressible dynamic stall. Initially, a stroboscopic schlieren technique was used for visualization of the stall process, but the primary research tool has been point diffraction interferometry(PDI), a technique carefully optimized for use in this project. A review of the process of development of PDI will be presented in the full paper. One of the most valuable aspects of PDI is the fact that interferograms are produced in real time on a continuous basis. The use of a rapidly-pulsed laser makes this practical; a discussion of this approach will be

presented in the full paper. This rapid pulsing (up to 40,000 pulses/sec) produces interferograms of the rapidly developing dynamic stall field in sufficient resolution (both in space and time) that the fluid physics of the compressible dynamic stall flowfield can be quantitatively determined, including the gradients of pressure in space and time. This permits analysis of the influence of the effect of pitch rate, Mach number, Reynolds number, amplitude of oscillation, and other parameters on the dynamic stall process. When interferograms can be captured in real time, the potential for real-time mapping of a developing unsteady flow such as dynamic stall becomes a possibility. This has been achieved in the present case through the use of a high-speed drum camera combined with electronic circuitry which has resulted in a series of interferograms obtained during a single cycle of dynamic stall; images obtained at the rate of 20 KHz will be presented as a part of the formal presentation. Interferometry has been available for a long time; however, most of its use has been limited to visualization. The present research has focused on use of interferograms for quantitative mapping of the flow over oscillating airfoils. Instantaneous pressure distributions can now be obtained semi-automatically, making practical the analysis of the thousands of interferograms that are produced in this research. A review of the techniques that have been developed as part of this research effort will be presented in the final paper.

Derived from text

*Imaging Techniques; High Speed; Fluid Dynamics; Aerodynamic Stalling; Helicopters; Holographic Interferometry; Flow Visualization; Flow Distribution*

**20020039931** Smithsonian Astrophysical Observatory, Central Engineering Dept., Cambridge, MA USA

**Investigation of Advanced Balloon Pointing Design and Technology Final Report, 15 Oct. 1999 - 14 Oct. 2001**

Nystrom, George, Smithsonian Astrophysical Observatory, USA; Cheimets, Peter, Smithsonian Astrophysical Observatory, USA; Podgorski, William, Smithsonian Astrophysical Observatory, USA; February 2002; 6p; In English

Contract(s)/Grant(s): NAG5-8844; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Smithsonian Astrophysical Observatory (SAO) originally proposed to develop independently a balloon launch-train math model based on knowledge attained from flight proven SAO balloon experiments and stabilization systems. This would aid in the design of future balloon-based, position stabilized, experiments. The model would then be available to all balloon experimenters and used to define improvements to the SAO stabilization systems. It would also identify areas of possible improvements to the balloon launch train itself. The final goal was to fly an instrumented test flight to validate both the math model and design improvements.

Derived from text

*Balloons; Balloon Flight; Mathematical Models; Research and Development*

**20020040064** Arkansas Univ., Computational Mechanics Lab., Fayetteville, AR USA

**Predicting the Nonlinear Response of Aerospace Structures Using Aeroelastic NS Solutions on Deforming Meshes Final Report, 1 Apr. 1998-31 Mar. 2001**

Selvam, R. P.; QU, ZU-Qing; Zheng, Qun; Roy, Uday K.; Nov. 2001; 174p; In English

Contract(s)/Grant(s): F49620-98-1-0396

Report No.(s): AD-A399278; AFRL-SR-BL-TR-02-0057; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

With the resurgent interest in flight vehicles such as the High-Speed Civil Transport (HSCT), the X-33 Advanced Technology Demonstrator, the Reusable Launch Vehicle (RLV), the Joint Strike Fighter (JSF) and the X-38 Spacecraft using a lifting-body concept that will operate at supersonic/hypersonic Mach numbers, the need for panel flutter analysis has received broad acknowledgement. The linear and nonlinear analysis of the panel flutter has been studied extensively during the past two decades. However, most of the researches on this area are concentrated on the structural side, i.e., panel or plate. In these researches, the approximate theories, such as quasi-steady piston theory, full linearized (inviscid) potential flow theory, etc., are used to estimate the aerodynamic pressure. This kind of linear aerodynamics may not be adequate to predict the dynamic characteristics of the fluid and structure because the fluid flow is strongly nonlinear at the transonic and supersonic speeds. As we know, the high-fidelity equations, such as Euler or Navier-Stokes equations, can predict the flow characteristics more accurately. One of the important reasons that the high-fidelity equations have not been used to predict the aerodynamic loads is that the corresponding numerical simulation is very computationally expensive. With the fast development of the computer techniques, the full analysis of the nonlinear panel flutter coupled with the Euler or Navier-Stokes flow equations becomes possible.

DTIC

*Aircraft Construction Materials; Aerospace Engineering; Navier-Stokes Equation; Panel Flutter; Aeroelasticity*

## AIR TRANSPORTATION AND SAFETY

*Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety; and 85 Technology Utilization and Surface Transportation.*

**20020039157** NASA Ames Research Center, Moffett Field, CA USA

**Effects of Special Use Airspace on Economic Benefits of Direct Flights**

Datta, Koushik, NASA Ames Research Center, USA; Barrington, Craig, NASA Ames Research Center, USA; [1996]; 20p; In English

Contract(s)/Grant(s): NAS2-13767; RTOP 538-04-15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A methodology for estimating the economic effects of Special Use Airspace (SUA) on direct route flights is presented in this paper. The methodology is based on evaluating operating costs of aircraft and analyzing the different ground-track distances traveled by flights under different air traffic scenarios. Using this methodology the following objectives are evaluated: optimistic bias of studies that assume accessible SUAs the maximum economic benefit of dynamic use of SUAs and the marginal economic benefit of the dynamic use of individual SUAs.

Author

*Air Traffic; Airspace; Operating Costs; Cost Analysis; Mathematical Models*

**20020039424** Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

**Operational Concept for the Smart Landing Facility (SLF)**

Thompson, S. D.; Bussolari, S. R.; Mar. 14, 2001; 46p; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): PB2001-104281; NASA/A-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this document is to describe an operational concept for the Smart Landing Facility (SLF). The SLF is proposed as a component of the Small Aircraft Transportation System (SATS) and is envisioned to utilize Communication, Navigation, Surveillance and Air Traffic Management (CNS/ATM) technologies to support higher-volume air traffic operations in a wider variety of weather conditions than are currently possible at airports without an Air Traffic Control Tower (ATCT) or Terminal Radar Approach Control (TRACON). In order to accomplish this, the SLF will provide aircraft sequencing and separation within its terminal airspace (the SLF traffic area) and on the airport surface. The approach taken in this report is to first define and describe the SLF environment and the type of operations and aircraft that must be supported. Services currently provided by an ATCT and TRACON are reviewed and assembled into a set of high-level operational functions. A description of the applicable CNS/ATM technologies that have been deployed in the NAS (National Airspace System) or have been demonstrated to be operationally feasible is presented. A candidate SLF system concept that employs the CNS/ATM technologies is described. This is followed by SLF operational scenarios for minimally-equipped aircraft and for aircraft fully-equipped to make full use of SLF services. An assessment is made of the SLF technology and key research issues are identified.

NTIS

*Air Traffic Control; Airports; Air Traffic*

**20020039478** NASA Ames Research Center, Moffett Field, CA USA

**A Risk Assessment Model for Reduced Aircraft Separation: A Quantitative Method to Evaluate the Safety of Free Flight**

Cassell, Rick, Rannoch Corp., USA; Smith, Alex, Rannoch Corp., USA; Connors, Mary, NASA Ames Research Center, USA; Wojciech, Jack, Federal Aviation Administration, USA; [1996]; 1p; In English

Contract(s)/Grant(s): 22-81U-4903; No Copyright; Avail: Issuing Activity; Abstract Only

As new technologies and procedures are introduced into the National Airspace System, whether they are intended to improve efficiency, capacity, or safety level, the quantification of potential changes in safety levels is of vital concern. Applications of technology can improve safety levels and allow the reduction of separation standards. An excellent example is the Precision Runway Monitor (PRM). by taking advantage of the surveillance and display advances of PRM, airports can run instrument parallel approaches to runways separated by 3400 feet with the same level of safety as parallel approaches to runways separated by 4300 feet using the standard technology. Despite a wealth of information from flight operations and testing programs, there is no readily quantifiable relationship between numerical safety levels and the separation standards that apply to aircraft on final approach. This paper presents a modeling approach to quantify the risk associated with reducing separation on final approach. Reducing aircraft separation, both laterally and longitudinally, has been the goal of several aviation R&D programs over the past

several years. Many of these programs have focused on technological solutions to improve navigation accuracy, surveillance accuracy, aircraft situational awareness, controller situational awareness, and other technical and operational factors that are vital to maintaining flight safety. The risk assessment model relates different types of potential aircraft accidents and incidents and their contribution to overall accident risk. The framework links accident risks to a hierarchy of failsafe mechanisms characterized by procedures and interventions. The model will be used to assess the overall level of safety associated with reducing separation standards and the introduction of new technology and procedures, as envisaged under the Free Flight concept. The model framework can be applied to various aircraft scenarios, including parallel and in-trail approaches. This research was performed under contract to NASA and in cooperation with the FAA's Safety Division (ASY).

Author

*Risk; Assessments; Flight Operations; Flight Safety; Free Flight*

**20020040563** Federal Aviation Administration, John A. Volpe National Transportation Systems Center, Cambridge, MA USA

**Runway Safety: It's Everybody's Business. We Want You to Put the Brakes on Runway Incursions** *Final Report*

Cardosi, Kim M.; Jul. 2001; 107p; In English

Report No.(s): AD-A399171; DOT-VNTSC-FAA-01-08; DOT/FAA-AR-01/66; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This booklet tell pilots and controllers what they can do to help prevent runway incursions by helping them to avoid situations that induce errors and alerting them to them to situations as extra vigilance is required. It also provides information on how controllers and pilots can help each other to work more effectively. Chapter topics include: communication, memory, teamwork, and fatigue.

DTIC

*Runways; Aircraft Safety; Communication*

**20020040843** NASA Ames Research Center, Moffett Field, CA USA

**Translating Research Into Airline Practice: Case Studies In Collaboration**

Dismukes, R. Key, NASA Ames Research Center, USA; Chappell, Sherry, NASA Ames Research Center, USA; Daniel, Doug, NASA Ames Research Center, USA; Mancuso, Vince, NASA Ames Research Center, USA; [1996]; 1p; In English; 9th International Symposium on Aviation Psychology, 27 Apr. - 1 May 1997, Columbus, OH, USA

Contract(s)/Grant(s): RTOP 505-64-13; No Copyright; Avail: Issuing Activity; Abstract Only

Airline training departments are avid customers for research that will help them enhance the effectiveness of training and the safety of flight operations. However, various factors often make it difficult for training department managers to draw upon the large body of human factors research, e.g.: research may not address the specific questions facing the training departments, the research literature may not be in a form that training managers can readily interpret, researchers' recommendations may be too expensive or impractical to implement, etc. This panel will discuss ways in which researchers can work with training departments to design research and translate findings into products that airlines can use readily. This collaboration is most effective when it is an integral part of the study from its inception. to illustrate the process of collaboration we will use as a case study the recently completed LOFT (Line Oriented Flight Training) Debriefing research project. We will summarize the findings from that study and discuss how we translated those findings into two training tools: a manual on how to facilitate LOFT debriefings and a video that illustrates facilitation techniques in a realistically enacted debriefing. In some cases, instead of starting a new research project, training department needs can be addressed by reviewing the existing research literature and using expert opinion to develop products that specifically address those needs. To illustrate this approach we will discuss a recent informal working group of scientists and airline personnel that met to develop training material to enhance situation awareness. This group reviewed scientific literature and ASRS (Aviation Safety Reporting System) reports, analyzed contributing factors, and produced a model for managing situation awareness.

Author

*Airline Operations; Civil Aviation; Education; Flight Operations; Manuals; Operations Research*

**20020040850** San Jose State Univ., Moffett Field, CA USA

**A Task-Analytic Approach to the Determination of Training Requirements for the Precision Descent**

Smith, Nancy, San Jose State Univ., USA; [1996]; 1p; In English; 9th International Symposium on Aviation Psychology, 27 Apr. - 1 May 1997, Columbus, OH, USA

Contract(s)/Grant(s): NCC2-232; No Copyright; Avail: Issuing Activity; Abstract Only

A task-analytic approach was used to evaluate the results from an experiment comparing two training methods for the "Precision Descent," a cockpit procedure designed to complement a new, computer-based air traffic control advisory system by

allowing air traffic controllers to assign precise descent trajectories to aircraft. A task model was developed for the procedure using a methodology that represents four different categories of task-related knowledge: (1) ability to determine current flight goals; (2) ability to assess the current flight situation relative to those goals; (3) operational knowledge about flight-related tasks; and (4) knowledge about task selection. This model showed what knowledge experienced pilots already possessed, and how that knowledge was supplemented by training material provided in the two training conditions. All flight crews were given a "Precision Descent Chart" that explained the procedure's clearances and compliance requirements. This information enabled pilots to establish appropriate flight goals for the descent, and to monitor their compliance with those goals. In addition to this chart, half of the crews received a "Precision Descent Bulletin" containing technique recommendations for performing procedure-related tasks. The Bulletin's recommendations supported pilots in task selection and helped clarify the procedure's compliance requirements. Eight type-rated flight crews flew eight Precision Descents in a Boeing 747-400 simulator, with four crews in each of the two training conditions. Both conditions (Chart and Chart-with-Bulletin) relied exclusively on the use of those documents to introduce the procedure. No performance feedback was provided during the experiment. Preliminary results show better procedure compliance and higher acceptability ratings from flight crews in the Chart-with-Bulletin condition. These crews performed flight-related tasks less efficiently, however, using the simpler but less efficient methods suggested in the Bulletin. When a more efficient method was recognized, these crews tended to use the more efficient method in addition to the Bulletin's recommendation, instead of replacing it.

Author

*Descent Trajectories; Air Traffic Control; Aircraft Pilots; Pilot Training; Computerized Simulation*

## 04

### AIRCRAFT COMMUNICATIONS AND NAVIGATION

*Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications; Spacecraft Communications, Command and Tracking, and 32 Communications and Radar.*

**20020039545** Technology Resources, Inc., Austin, TX USA

**POWER: Objective Activity and Taskload Assessment in En Route Air Traffic Control** *Final Report*

Mills, Scott H., Technology Resources, Inc., USA; Pfleiderer, Elaine M., Civil Aerospace Medical Inst., USA; Manning, Carol A., Civil Aerospace Medical Inst., USA; February 2002; 24p; In English

Contract(s)/Grant(s): AM-B-01-HRR-516

Report No.(s): DOT/FAA/AM-02/2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two computer programs, the National Airspace System (NAB) Data Management System (NORMS) and the Performance and Objective Workload Evaluation Research (POWER) program, have been developed to provide a platform for quantifying en route air traffic controller activity and taskload. The NORMS program extracts data produced by en route mainframe computers and encodes the information into database files that provide efficient storage and access. The POWER program calculates specific measures using aircraft positions and controller data entries. The development and use of such measures is important for establishing baseline activity measures and for evaluating modifications to ATC systems. NAB System Analysis Recording (BAR) data were collected from the Jacksonville en route air traffic control center between 8:30-10:30 a.m. and between 12:00-2:00 p.m. (local time) for each of four consecutive days. POWER measures were computed in 30-minute intervals for all active sectors. A Principal Components Analysis (PCA) was conducted to evaluate the current set of POWER variables and provide guidelines for the addition of new measures or the modification of existing ones. PCA with Varimax rotation converged in seven iterations and produced five components with eigenvalues greater than 1. Cumulatively, the four components accounted for 68.18% of the variability in the data set: Component 1 (Activity) accounted for 26%, Component 2 (Flight Path Variability) accounted for nearly 13%, Component 3 (Objective Workload) accounted for 11%, Component 4 (D-side Activity) accounted for 9%, and Component 5 (Overload) accounted for approximately 8%. Variables comprising the five extracted components provided valuable information about the underlying dimensions of the NAB data set. Additions or modifications that might improve the ability of POWER to describe ATC activity and taskload were identified.

Author

*Air Traffic Control; Computer Programs; Flight Management Systems; Principal Components Analysis*

**20020039731** NASA Ames Research Center, Moffett Field, CA USA

**Automation for Air Traffic Control: The Rise of a New Discipline**

Erzberger, Heinz, NASA Ames Research Center, USA; [1997]; 1p; In English; AIAA 35th Aerospace Sciences Meeting and

Exhibit, 6-8 Jan. 1997, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA  
Contract(s)/Grant(s): RTOP 505-64-13; No Copyright; Avail: Issuing Activity; Abstract Only

The current debate over the concept of Free Flight has renewed interest in automated conflict detection and resolution in the enroute airspace. An essential requirement for effective conflict detection is accurate prediction of trajectories. Trajectory prediction is, however, an inexact process which accumulates errors that grow in proportion to the length of the prediction time interval. Using a model of prediction errors for the trajectory predictor incorporated in the Center-TRACON Automation System (CTAS), a computationally fast algorithm for computing conflict probability has been derived. Furthermore, a method of conflict resolution has been formulated that minimizes the average cost of resolution, when cost is defined as the increment in airline operating costs incurred in flying the resolution maneuver. The method optimizes the trade off between early resolution at lower maneuver costs but higher prediction error on the one hand and late resolution with higher maneuver costs but lower prediction errors on the other. The method determines both the time to initiate the resolution maneuver as well as the characteristics of the resolution trajectory so as to minimize the cost of the resolution. Several computational examples relevant to the design of a conflict probe that can support user-preferred trajectories in the enroute airspace will be presented.

Author

*Air Traffic Control; Automatic Control; Free Flight; Trajectories; Predictions; Air Traffic*

**20020040373** Civil Aeromedical Inst., Civil Aeromedical Inst., Oklahoma City, OK USA

**The Effects of Workload and Decision Support Automation on Enroute R-Side and D-Side Communication Exchanges**

Bailey, Larry L.; Willems, Ben F.; Peterson, Linda M.; Dec. 2001; 20p; In English

Report No.(s): AD-A399353; DOT/FAA/AM-01/20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Federal Aviation Administration (FAA) is introducing new decision aid technology, called decision support tools (DSTs), into the air traffic control (ATC) workforce. Although considerable research has focused on the effects that DSTs will have on pilot-controller communications, relatively little research has been conducted on how DSTs will affect controller-controller communications. In this study, we examined the effects that aircraft density and different types of DSTs have on the communication exchanges occurring within en route ATC teams. Two hypotheses guided the research. Hypothesis 1: More communication exchanges will occur under high workload conditions, as compared with low workload conditions; Hypothesis 2: More communication exchanges will occur when using DSTs, as compared with not using DSTs. Eight two-person teams, consisting of certified ATC specialists from an en route center, participated in a decision support automation research experiment. In the experiment communication exchanges of team members were assessed within a 2 (aircraft density) X 3 (type of DST) repeated measures design. Communications were analyzed by an ATC subject matter expert using an FAA ATC communication taxonomy consisting of three categories: the topic of communication, the grammatical form of communication, and the mode of communication. A total of 3,194 communication events were coded. Partial support was achieved for hypothesis 1. When communications were analyzed as a composite number, no statistically significant results were observed. However, when the categories were analyzed separately, main effects for aircraft density were observed for two communication topics: general communications about a specific aircraft,  $F(1,5) = 11.25$ ,  $p$  is less than .05, and communications involving altitude changes,  $F(1,5) = 10.66$ ,  $P$  is less than .05. In both cases, there were more communications associated with the high-aircraft-density condition.

DTIC

*Air Traffic Control; Workloads (Psychophysiology); Decision Support Systems*

## 05

### AIRCRAFT DESIGN, TESTING AND PERFORMANCE

*Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.*

**20020039162** NASA Dryden Flight Research Center, Edwards, CA USA

**Ground and Flight Evaluation of a Small-Scale Inflatable-Winged Aircraft**

Murray, James E., NASA Dryden Flight Research Center, USA; Pahle, Joseph W., NASA Dryden Flight Research Center, USA; Thornton, Stephen V., NASA Dryden Flight Research Center, USA; Vogus, Shannon, NASA Dryden Flight Research Center, USA; Frackowiak, Tony, Analytical Services and Materials, Inc., USA; Mello, Joe, California Polytechnic State Univ., USA; Norton, Brook, Vertigo, Inc., USA; January 2002; 20p; In English; 40th AIAA Aerospace Sciences Meeting and Exhibit, 14-17 Jan. 2002, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 274-00-00-E8-RR

Report No.(s): NASA/TM-2002-210721; H-2471; NAS 1.15:210721; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A small-scale, instrumented research aircraft was flown to investigate the night characteristics of innersole wings. Ground tests measured the static structural characteristics of the wing at different inflation pressures, and these results compared favorably with analytical predictions. A research-quality instrumentation system was assembled, largely from commercial off-the-shelf components, and installed in the aircraft. Initial flight operations were conducted with a conventional rigid wing having the same dimensions as the inflatable wing. Subsequent flights were conducted with the inflatable wing. Research maneuvers were executed to identify the trim, aerodynamic performance, and longitudinal stability and control characteristics of the vehicle in its different wing configurations. For the angle-of-attack range spanned in this flight program, measured flight data demonstrated that the rigid wing was an effective simulator of the lift-generating capability of the inflatable wing. In-flight inflation of the wing was demonstrated in three flight operations, and measured flight data illustrated the dynamic characteristics during wing inflation and transition to controlled lifting flight. Wing inflation was rapid and the vehicle dynamics during inflation and transition were benign. The resulting angles of attack and of sideslip are small, and the dynamic response was limited to roll and heave motions.

Author

*Flight Operations; Research Aircraft; Aerodynamic Characteristics; Inflatable Gliders; Aircraft Performance; Structural Analysis*

**20020039422** Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France

**Design Loads for Future Aircraft *Les Charges de Calcul pour de Futurs Aeronefs***

February 2002; 300p; In English; Original contains color illustrations

Report No.(s): RTO-TR-045; AC/323(AVT-024)TP/30; ISBN 92-837-1077-0; Copyright Waived; Avail: CASI; C01, CD-ROM; A13, Hardcopy; A03, Microfiche

This RTO (Research and Technology Organization, NATO (North Atlantic Treaty Organization)) Task Group reviewed the requirements which regular flight and maneuvering will put as design loads on the structure of future NATO aircraft, addressing also safety aspects, structural weight, elastic effects and influence of the control system. Treated are: load critical flight maneuvers as well as external loads such as induced by turbulence. Existing specifications are reviewed and procedures for establishing design loads are presented. Metal and composite structures are treated, and the analysis pertains to main structures as well as critical subassemblies. Under operational aspects the monitoring of loads and of structural fatigue are treated and some actual failure cases are analyzed. The request for NATO agreements on relevant design criteria is mentioned.

Author

*Design Analysis; Aircraft Design; Aircraft Specifications; Aircraft Safety; North Atlantic Treaty Organization (NATO)*

**20020039999** Duke Univ., Durham, NC USA

**Aeroelastic Leveraging and Control through Adaptive Structures *Final Report, 1 Apr. 1999-30 Nov. 2001***

Clark, Robert L.; Jan. 15, 2001; 140p; In English

Contract(s)/Grant(s): F49620-99-1-0253

Report No.(s): AD-A399161; AFRL-SR-BL-TR-01-0056; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The primary objective of the proposed program is to develop and design a distributed actuation methodology for wing warping in UCAVs aimed at: (1) control of higher-order flutter modes; (2) increased maneuverability; and (3) reduced radar signature. Specific milestones achieved during the funded phase of the program include: (1) Completed design and testing of high aspect ratio wing model in Duke University Wind Tunnel to correlate computer model used to design wing - LCO/Flutter; (2) Completed design and bench testing of V-Stack actuator for integration into airfoil; (3) Completed design specifications for a typical section wind tunnel model to evaluate performance of V-stack actuator with a single control surface; (4) Performed initial design of continuously deformable control surface and evaluated performance for flutter suppression; and (5) Developed reduced-order models to evaluate enhanced roll performance of a warped, adaptive, aeroelastic wing.

DTIC

*Aeroelasticity; Wind Tunnel Tests; Wings; Adaptive Control*

**20020040072** RAND Corp., Santa Monica, CA USA

**RAND Research Brief: New Processes for the Estimation of Military Airframe Costs**

Jan. 2001; 2p; In English

Report No.(s): AD-A399235; RAND/RB-79-AF; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Since the end of the Cold War, large-scale reductions in defense allocations have prompted both the Department of Defense and Congress to place an increasingly high premium on the affordability of weapon systems. Yet many aircraft contractors and government program managers have long maintained that government cost estimators have consistently overestimated the costs of such systems by virtue of their reliance on outdated forecasting methodologies. The generation of more timely cost-estimating models would thus appear to form the cornerstone of sound acquisition policy. In *Military Airframe Costs: The Effects of Advanced Materials and Manufacturing Processes*, RAND researchers Obaid Younossi, Michael Kennedy, and John C. Graser address this issue by updating existing cost-estimating methodologies in the critical area of military airframes. After providing basic background information on the various materials that are used to produce airframe structures, the authors discuss the relative advantages of both traditional and evolving manufacturing techniques. Drawing from an industry survey as well as from part-manufacturing data, they then analyze how the cost of producing airframe structures varies with material mix, manufacturing technique, and part geometric complexity. The data thus derived are then integrated with those from a comprehensive historical cost database to yield a more accurate means of generating airframe cost projections.

DTIC

*Airframes; Costs; Manufacturing*

**20020040096** Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Victoria, Australia  
**Static and Fatigue Testing of Mechanical Life Extension Options for Plates Containing Elongated Holes**

Evans, Rebecca L.; Heller, Manfred; Aug. 2001; 69p; In English; Original contains color images

Report No.(s): AD-A399214; DSTO-TR-1202; DODA-AR-012-007; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

F-111 representative static and fatigue testing has been undertaken to assess the suitability of AMRL designed stress-bridge and interference-fit plug options for the fatigue life enhancement of plates containing non-circular elongated holes of 2:1 aspect ratio. For the stress-bridge design, an improvement in strain concentration factor of 38% was demonstrated for lower magnitude remote loads as compared to plates with unenhanced holes. Conversely, during typical high loads, the alternating strain range was negligibly improved due to slipping of the feet. Hence during the fatigue tests there was extensive specimen cracking. However, excellent results were achieved with the interference-fit plug design, where the peak elastic strain concentration factor was reduced by 79% as compared to the unenhanced case. This design also prevented the introduction of detrimental residual tensile stresses during high loads. Consequently, for these enhanced specimens, crack growth during fatigue testing was completely prevented, and very large extensions in fatigue lives were demonstrated. Thus the interference-fit plug is considered a very suitable option for the fatigue life extension of elongated holes such as the critical fuel flow vent holes in the F-111 wing pivot fitting.

DTIC

*F-111 Aircraft; Aircraft Maintenance; Structural Analysis; Holes (Mechanics); Static Tests; Fatigue Tests*

**20020040099** Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA

**Aerodynamic Studies of Micro Air Vehicles Final Report, 1 Sep. 1998-30 Sep. 2001**

Reed, Helen L.; Saric, William S.; Dec. 20, 2001; 11p; In English

Contract(s)/Grant(s): F49620-99-1-0089

Report No.(s): AD-A399230; AFRL-SR-BL-TR-02-0047; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The program at Arizona State University (ASU) consisted of complementary experimental, computational, and flight-test elements that examined the aerodynamics of Micro Aerial Vehicles (MAVs). All these components supported the actual design of our MAV, called MAVRIC (Micro Aerial Vehicle Research Initiative and Competition) and which competed for two years against other university teams. MAVs are characterized by low operating chord Reynolds numbers and thus present challenges in viscous aerodynamics. Our studies focused on the effects on performance of different wing-body-juncture and wing-tip designs. MAV aerodynamics is strongly affected by the wing-tip vortices which extend over a significant amount of span. Blending the wing and fuselage and adding winglets provided a reduction in the extent of these vortices as well as a refocusing of them away from the lifting surface.

DTIC

*Aerodynamics; Wings; Computational Fluid Dynamics*

**20020040105** RAND Corp., Santa Monica, CA USA

**RAND Research Brief: Lean Manufacturing and the Defense Industry. Lessons for Cost Analysts**

Jan. 2001; 4p; In English

Report No.(s): AD-A399239; RAND/RB-80-AF; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Since the end of the Cold War, the Department of Defense (DoD) has launched a number of initiatives whose common objective has been to reduce the costs of weapon systems that are planned, under development, or in production. Largely in response to these measures, US defense firms have in recent years begun to embrace lean manufacturing, a broad collection of principles and practices whose aim is to refashion the production process in a manner that includes the elimination of waste, the removal of inventory buffers, and a focus on quality. To date, however, few studies have been undertaken to determine the extent to which government cost-estimating tools should be appropriately adjusted to reflect the growing use of such practices within the military aircraft industry.

DTIC

*Manufacturing; Military Aircraft; Weapon Systems; Defense Industry; Cost Reduction*

**20020040795** Air Force Research Lab., Wright-Patterson AFB, OH USA

**An Investigation of the Aeroelastic Tailoring for Smart Structure Concepts Final Report, 23 Aug. 1993-1 Apr. 1996**

Giese, Cindy L.; Reich, Gregory W.; Hopkins, Mark A.; Griffin, Kenneth E.; Apr. 1996; 9p; In English

Contract(s)/Grant(s): Proj-2401

Report No.(s): AD-A399629; AFRL-VA-WP-TR-2002-3006; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report describes a research effort demonstrating the concept of variable stiffness tailored aeroelasticity for smart structures. In particular, a wing structure is designed, or tailored aeroelastically, as a force multiplier for control actuation. This variable stiffness concept may be used as a way to employ light-weight and low-power output smart materials in lifting surface structures. A simple, unswept, rectangular wing model is used to explore the feasibility of utilizing the variable stiffness tailored structure as a force multiplier in conjunction with an outboard, trailing edge control surface. This approach involves the design of a simple wing model with adjustable stiffness to lower the control surface dynamic pressure and use the control surface as a 'tab' to twist the wing.

DTIC

*Aeroelasticity; Control Surfaces; Smart Materials; Smart Structures*

**20020040863** General Accounting Office, Washington, DC USA

**Airport Infrastructure: Unresolved Issues Make It Difficult to Determine the Cost to Serve New Large Aircraft. Congressional Requesters**

Feb. 2002; 27p; In English

Report No.(s): AD-A399530; GAO-02-251; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Airbus Industries (Airbus), 1 the European manufacturer of large commercial aircraft, plans to introduce New Large Aircraft (NLA) to U.S. airports in 2006. 2 Airports, such as New York's John F. Kennedy International (JFK) and Los Angeles International, which now provide service to the Boeing 747 (B-747), currently the largest commercial aircraft, as well as those that serve as hubs for airlines that might purchase NLA, are likely candidates to serve these new aircraft. The Federal Aviation Administration (FAA) sets the design standards that govern how an airport must be configured to safely serve aircraft with certain wingspans and weight. A B-747 operates under Design Group V standards, while FAA has determined that NLA will operate under Design Group VI standards. Currently, FAA is reviewing the standards for NLA, which were published in 1983, to determine whether they should be revised.

DTIC

*Airports; European Airbus; Airline Operations*

**20020040879** Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA

**Ground and Flight Testing of a Boeing 737 Center Wing Fuel Tank Inerted with Nitrogen-Enriched Air Final Report**

Burns, Michael; Cavage, William M.; Aug. 2001; 34p; In English; Original contains color images

Report No.(s): AD-A399356; DOT/FAA/AR-01/63; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A series of aircraft flight and ground tests were performed by the Federal Aviation Administration (FAA) and the Boeing Company to evaluate the effectiveness of ground-based inerting (GBI) as a means of reducing the flammability of fuel tanks in the commercial transport fleet. Boeing made available a model 737-700 for modification and testing. A nitrogen-enriched air (NEA) distribution manifold, designed, built, and installed by Boeing, allowed for deposit of the ground-based NEA into the center wing tank (CWT). The fuel tank was instrumented with gas sample tubing and thermocouples to allow for a measurement of fuel tank inerting and heating during the testing. The FAA developed an in-flight gas-sampling system, integrated with eight oxygen analyzers, to continuously monitor the ullage oxygen concentration at eight different locations. Other data such as fuel load, air speed, altitude, and similar flight parameters were made available from the aircraft data bus. A series of ten tests were performed (five flight, five ground) under different ground and flight conditions to demonstrate the ability of GBI to reduce fuel

tank flammability. The CWT was inerted with NEA to approximately 8% oxygen concentration by volume for each test. The aircraft condition was then set (fuel load, wind condition, and flight condition), and the oxygen concentration in the CWT was continuously monitored. Results showed that, under quiescent conditions, the oxygen concentration in the fuel tank remained somewhat constant, keeping the CWT inert (below 10 to 12% oxygen by volume) for relatively long periods of time. However, due to the cross venting configuration of Boeing aircraft, certain wind conditions created cross venting within the CWT which allowed for significant increases in the oxygen concentration. Some flight conditions also contributed to cross venting and created high oxygen concentrations within the fuel tank.

DTIC

*Fuel Tanks; Oxygen; Venting; Wing Tanks*

**20020040904** NASA Ames Research Center, Moffett Field, CA USA

**Comparison of Hover/Ground-Effect Characteristics for a Joint Strike Fighter Configuration**

Hange, Craig, NASA Ames Research Center, USA; Naumowicz, Tim, NASA Ames Research Center, USA; Wardwell, Douglas, NASA Ames Research Center, USA; Margason, Richard, NASA Ames Research Center, USA; Arledge, Tom, NASA Ames Research Center, USA; [1996]; 1p; In English; International Powered Lift Conference, 18-21 Nov. 1996, West Palm Beach, FL, USA; Sponsored by Society of Automotive Engineers, Inc., USA

Contract(s)/Grant(s): RTOP 505-68-32; No Copyright; Avail: Issuing Activity; Abstract Only

Hover and ground-effect tests were conducted with the Lockheed-Martin Large Scale Powered Model (LSPM) during June-November 1995 at the NASA Ames Research Center's Outdoor Aerodynamics Research Facility (OARF). This was done in support of the Joint Strike Fighter (JSF) Program being lead by the Department of Defense. The program was previously metered to as the Joint Advanced Strike Technology (JAST) Program. The tests at the OARF included: engine thrust calibrations out of ground effect, measurements of individual nozzle jet pressure decay characteristics, and jet-induced hover force and moment measurements in and out of ground effect. The engine calibrations provide data correlating propulsion system throttle and nozzle settings to thrust forces and moments for the bare fuselage with the wings, canards, and tails removed. This provides propulsive forces and moments while minimizing any of the effects due to the presence of the airframe. The engine calibrations were used later to determine thrust for hover testing at the OARF and for transition testing which took place in the NASA Ames 80 by 120 foot Wind Tunnel. The jet decay characteristics reflect the jet entrainment properties and are related to the aircraft suckdown characteristics. The JSF program provided the opportunity to obtain model scale effects using two models; one at small scale and one at large scale. Examples of data from these tests will be presented out of ground effect which will demonstrate the effect of scale. For one JSF configuration, two small-scale models and one large-scale model were tested and obtained different values for the lift loss out of ground effect. These differences were examined and are found to be largely dependent on the jet efflux characteristics. The jet-induced hover forces and moments are presented in and out of ground effect. For the hover testing the model is methodically built up from the bare fuselage, to include the wings, canards, and vertical tails, to determine the effects of each. Other components such as weapons bay doors, landing gear doors, and other lift improvement devices and their effect on the jet-induced forces and moments are examined.

Author

*Ground Effect (Aerodynamics); Hovering; Wind Tunnel Models; Stability Derivatives; Thrust; Wind Tunnel Tests*

## 06

### AVIONICS AND AIRCRAFT INSTRUMENTATION

*Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.*

**20020040810** Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA

**Night Vision Imaging System (NVIS) Compatibility and Visibility of the F-16 Common Configuration Implementation Program (CCIP) Common Color Multi-Function Display (CCMFD) Interim Report, Nov. 2000-Feb. 2001**

Marasco, Peter L.; Bowyer, Reginald L.; Boulter, Albert E.; Nov. 2001; 32p; In English; Prepared in collaboration with F-16 System Program Office, Air Force Aeronautical Systems Center, Wright Patterson AFB OH 45433

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A399689; AFRL-HE-WP-TR-2002-0006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

After preliminary operational testing of the Honeywell F-16 Common Configuration Implementation Program (CCIP) Common Color Multi-Function Display (CCMFD), a display intended to incorporate color into night vision imaging system (NVIS) compatible cockpits, some observers felt that the CCMFD did not present video with the same level of detail in NVIS mode as seen in daytime mode. It was also believed that the CCMFD might be interfering with vision through night vision goggles (NVGs), noticeably reducing visual acuity. In addition, pilots wearing NVGs felt that the display was too dim to easily read under certain conditions after prolonged NVG exposure. To address these concerns, the Air Force Research Laboratory, Human Effectiveness Directorate, AFRL/HECV, ran a series of tests with the assistance of the F-16 SPO, the Air Force Reserve and Air National Guard Test Center (AATC/DO), Honeywell, and Lockheed-Martin, to assess the NVIS compatibility and legibility of the CCMFD in its NVIS mode. This paper documents both the results of this testing and an analysis of subjective comments made by observers during a demonstration of the display under the suspect conditions noted by AATC/DO.

DTIC

*Night Vision; Color; Display Devices; F-16 Aircraft*

## 07

### AIRCRAFT PROPULSION AND POWER

*Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.*

**20020039743** State Univ. of New York, Dept. of Mechanical and Aerospace Engineering, Buffalo, NY USA

**Filtered Mass Density Function for Design Simulation of High Speed Airbreathing Propulsion Systems** *Semiannual Report, 1 Sep. 2001 - 28 Feb. 2002*

Drozda, T. G., State Univ. of New York, USA; Sheikhi, R. M. H., State Univ. of New York, USA; Givi, P., State Univ. of New York, USA; [2002]; 12p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-2238; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this research is to develop and implement a new methodology for large eddy simulation of (LES) of high-speed reacting turbulent flows. We have just completed 2 1/2 years of Phase I of this research. The work within the past six months was concentrated on the following two subjects: (1) Development of the joint velocity-scalar filtered density function (VSFDF) scheme for LES. (2) Implementation of our previously developed scalar filtered density function (SFDF) for flame simulations.

Author

*Air Breathing Engines; Large Eddy Simulation; Hypersonics; Propulsion System Configurations; Aerospace Engineering; Mass Flow Rate*

**20020040811** North Dakota State Univ., Fargo, ND USA

**High Performance Power Supply for the More Electric Aircraft** *Final Report, 1 Nov. 1997-31 Jul. 2001*

Yuvarajan, Subbaraya; Feb. 21, 2001; 3p; In English

Contract(s)/Grant(s): F49620-98-0081

Report No.(s): AD-A399688; AFRL-SR-BL-TR-02-0088; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The project is to develop a power supply system consisting of: (1) a single-phase Pre-regulator power factor corrector (ac-dc converter); and (2) a dc-dc converter.

DTIC

*Electric Power Supplies; Direct Current; Fly by Wire Control*

**20020040849** NASA Ames Research Center, Moffett Field, CA USA

**STOVL Jet Efflux Characteristics and their Influence on Propulsion-Induced Effects**

Arlledge, Tom, NASA Ames Research Center, USA; Wardwell, Doug, NASA Ames Research Center, USA; Hange, Craig, NASA Ames Research Center, USA; Naumowicz, Tim, NASA Ames Research Center, USA; [1996]; 1p; In English; International Powered Lift Conference, 18-21 Nov. 1996, West Palm Beach, FL, USA; Sponsored by Society of Automotive Engineers, Inc., USA

Contract(s)/Grant(s): RTOP 505-68-32; No Copyright; Avail: Issuing Activity; Abstract Only

Jet efflux characteristics are a determining factor in STOVL aircraft aero/propulsion induced effects. Subcritical jets may have core lengths which range up to 6 diameters. The shorter core length jets tend to entrain ambient air more rapidly, inducing

larger hover lift losses, and decay more rapidly, reducing adverse ground erosion. In transition flight, shorter core length jets show a larger decrease in the lift loss and a slight decrease in nose-up pitching moment. Supercritical pressure ratio jets tend to have longer, higher pressure core lengths with a greater hazard for ground erosion. The decay in the fully developed region is similar for both subcritical and supercritical pressure ratio jets. For subsonic jets the decay is inversely proportional to the distance from the jet exit. In ground effect the supercritical jet induces an oscillating pressure distribution on the ground with reflected shocks and expansions which can increase ground erosion and, at low ground heights, cause non-monotonic lift loss variations.

Author

*V/STOL Aircraft; Aircraft Engines; Efflux; Propulsion; Hovering; Gas Jets*

## 08

### AIRCRAFT STABILITY AND CONTROL

*Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also 05 Aircraft Design, Testing and Performance and 06 Avionics and Aircraft Instrumentation.*

**20020039287** NASA Ames Research Center, Moffett Field, CA USA

#### **Design for Vibration Monitoring: A Methodology for Reliable and Cost-Effective Vibration Monitoring**

Tumer, Irem Y., NASA Ames Research Center, USA; [2001]; 17p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of health monitoring systems is to detect failures or defects for increased safety and performance and to provide on-condition maintenance with reduced costs. The problems associated with health monitoring systems include high rates of false alarms and missed failures, which make monitoring an unreliable and costly task. The reason for this is that unaccounted variations invalidate signal modeling assumptions. Our approach was to focus on vibration monitoring of rotating components. We analyzed baseline signals to determine statistical variations, identify and model factors that influence vibrations (pre-production vs. post-production variations), determine hit and false alarm rates with baseline flight data, model and predict effects of defects and variations on vibrations, and develop algorithms and metrics for failure and anomaly detection in the presence of variations.

Derived from text

*Defects; Detection; False Alarms; Vibration; Systems Health Monitoring*

**20020039534** NASA Langley Research Center, Hampton, VA USA

#### **Piloted Simulation Assessment of a High-Speed Civil Transport Configuration**

Jackson, E. Bruce, NASA Langley Research Center, USA; Raney, David L., NASA Langley Research Center, USA; Glaab, Louis J., Lockheed Martin Engineering and Sciences Co., USA; Derry, Stephen D., NASA Langley Research Center, USA; March 2002; 476p; In English

Contract(s)/Grant(s): RTOP 537-07-24

Report No.(s): NASA/TP-2002-211441; L-17587; NAS 1.60:211441; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche

An assessment of a proposed configuration of a high-speed civil transport was conducted by using NASA and industry research pilots. The assessment was conducted to evaluate operational aspects of the configuration from a pilot's perspective, with the primary goal being to identify potential deficiencies in the configuration. The configuration was evaluated within and at the limits of the design operating envelope to determine the suitability of the configuration to maneuver in a typical mission as well as in emergency or envelope-limit conditions. The Cooper-Harper rating scale was used to evaluate the flying qualities of the configuration. A summary flying qualities metric was also calculated. The assessment was performed in the Langley six-degree-of-freedom Visual Motion Simulator. The effect of a restricted cockpit field-of-view due to obstruction by the vehicle nose was not included in this study. Tasks include landings, takeoffs, climbs, descents, overspeeds, coordinated turns, and recoveries from envelope limit excursions. Emergencies included engine failures, loss of stability augmentation, engine inlet unstarts, and emergency descents. Minimum control speeds and takeoff decision, rotation, and safety speeds were also determined.

Author

*Flight Characteristics; Motion Simulators; Pilots (Personnel); Flight Simulation; Supersonic Transports*

**20020040372** Monterey Technologies, Inc., Monterey, CA USA

#### **Human Factors Design Guidelines for Multifunction Displays Final Report**

Mejdal, Sig; McCauley, Michael E.; Beringer, Dennis B.; Oct. 2001; 77p; In English

Report No.(s): AD-A399354; DOT/FAA/AM-01/17; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

References related to the design of multifunction displays (MFDs) are summarized into a series of human factors design guidelines. These are presented in a number of sections, which include: general guidelines, the design process, air traffic displays, weather displays, navigation displays, MFD menu organization, automation, individual displays, and general design principles for aircraft displays. Particularly relevant data graphs are included to illustrate some of the recommendations. These sections are followed by samples from the extant body of guidelines and standards.

DTIC

*Display Devices; Human Factors Engineering; Navigation Aids; Air Traffic*

## 09

### RESEARCH AND SUPPORT FACILITIES (AIR)

*Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see 03 Air Transportation and Safety. For astronomical facilities see 14 Ground Support Systems and Facilities (Space).*

**20020040409** General Accounting Office, Washington, DC USA

**METROPOLITAN WASHINGTON AIRPORTS AUTHORITY: Contracting Practices Do Not Always Comply with Airport Lease Requirements**

Mar. 2002; 80p; In English; Report to Congressional Committee

Report No.(s): AD-A399468; GAO-02-36; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Metropolitan Washington Airports Act of 1986 provided for the lease of Washington Dulles International Airport (Dulles) and Ronald Reagan Washington National Airport (Reagan National) and the transfer of operating responsibility from the federal government to the Metropolitan Washington Airports Authority. The Authority is an independent, nonfederal, public entity that has operated the government-owned airports since June 7, 1987, under a 50-year lease with the U.S. Department of Transportation. The transfer of operating responsibility was intended to facilitate timely improvements at the airports to meet the growing demand for air transportation.

DTIC

*Contracts; Airports; Government Procurement*

**20020040902** NASA Ames Research Center, Moffett Field, CA USA

**An Initial Examination of Roll-Lateral Coordination Motion Requirements in Flight Simulation**

Schroeder, Jeffery A., NASA Ames Research Center, USA; Chung, William W., NASA Ames Research Center, USA; Laforce, Soren, SYRE Corp., USA; [1996]; 1p; In English; World Aviation Congress, 22-24 Oct. 1996, Los Angeles, CA, USA

Contract(s)/Grant(s): RTOP 538-04-13; No Copyright; Avail: Issuing Activity; Abstract Only

A piloted simulation that examined the effects of uncoordinated roll-lateral motion cues from a coordinated math model was conducted. The vehicle model represented a typical helicopter with satisfactory handling qualities in the roll-lateral axes. The task was a two-degree-of-freedom horizontal sidestep, where the pilot controlled lateral position through roll angle. The motion platform commands were varied via two motion control system gains. One gain reduced the ratio between platform roll angle to math model (and thus visual) roll angle. The other gain was placed on how much lateral platform movement would result from platform roll attitude in an attempt to align the apparent gravity vector vertically relative to the pilot. Gains from one to zero were examined in both axes. Thus, the true 1:1 motion case, where the motion cues matched the visual cues was evaluated. Pilots subjective ratings of motion fidelity matched well against an earlier developed motion fidelity criteria. Significant differences were noted in the fixed-base versus motion base configurations.

Author

*Roll; Lateral Control; Motion Simulation; Flight Simulation; Coordination*

## ASTRONAUTICS (GENERAL)

*Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see categories 13 through 20. For extraterrestrial exploration, see 91 Lunar and Planetary Science and Exploration.*

**20020040346** Defence Science and Technology Organisation, Airframes and Engines Div., Fishermans Bend, Australia

### **Static and Fatigue Testing of Mechanical Life Extension Options for Plates Containing Elongated Holes**

Evans, R. L., Defence Science and Technology Organisation, Australia; Heller, M., Defence Science and Technology Organisation, Australia; August 2001; 74p; In English; Original contains color illustrations

Report No.(s): DSTO-TR-1202; DODA-AR-012-007; Copyright; Avail: Issuing Activity

F-111 representative static and fatigue testing has been undertaken to assess the suitability of AMRL (Aeronautical and Maritime Research Lab, Australia) designed stress-bridge and interference-fit plug options for the fatigue life enhancement of plates containing non-circular elongated holes of 2:1 aspect ratio. For the stress-bridge design, an improvement in strain concentration factor of 38% was demonstrated for lower magnitude remote loads as compared to plates with unenhanced holes. Conversely, during typical high loads, the alternating strain range was negligibly improved due to slipping of the feet. Hence during the fatigue tests there was extensive specimen cracking. However, excellent results were achieved with the interference-fit plug design, where the peak elastic strain concentration factor was reduced by 79% as compared to the unenhanced case. This design also prevented the introduction of detrimental residual tensile stresses during high loads. Consequently, for these enhanced specimens, crack growth during fatigue testing was completely prevented, and very large extensions in fatigue lives were demonstrated. Thus the interference-fit plug is considered a very suitable option for the fatigue life extension of elongated holes such as the critical fuel flow vent holes in the F-111 wing pivot fitting.

Author

*Fatigue Tests; Holes (Mechanics); Interference Fit; Plugs; Static Tests*

**20020040784** Air Force Research Lab., Edwards AFB, CA USA

### **Battery Failure on the Electric Propulsion Space Experiment (ESEX)**

Bromaghim, Daron R.; Nov. 2001; 31p; In English

Contract(s)/Grant(s): AF Proj. 6340

Report No.(s): AD-A399479; AFRL-PR-ED-TR-2001-0027; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The anomaly experienced on the USAF Electric Propulsion Space Experiment (ESEX) mission related to the silver-zinc battery is described. The on-orbit observations of the battery behavior in relationship to the thruster firings are summarized, as well as a description of the catastrophic failure which ended the ESEX mission. Although a final cause of the battery failure was not definitized, the data collected on-orbit, from ground tests, and from previous programs suggest a combination of effects that ultimately led to electrolyte leakage, and a subsequent short circuit between the battery cells and the case. The contributing effects likely include degradation of the mechanical interconnections between the cells, inadequate charge current, and excessive discharge current requirements. Lessons learned from the ESEX experience focus on the need for more realistic simulations of the on-orbit operations during ground test including the use of actual flight hardware and the associated timelines as much as possible.

DTIC

*Space Missions; Electric Propulsion; Silver Zinc Batteries; Failure; Electric Batteries*

## GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

*Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also 09 Research and Support Facilities (Air).*

**20020040108** AMPTEk, Inc., Bedford, MA USA

### **Compact Environmental Anomaly Sensor (CEASE) Flight Integration Support Contract *Final Report, 15 Apr. 1996-1 Jan. 2001***

Redus, Robert H.; McGarity, John O.; Jordanov, Valentin T.; Huber, Alan C.; Dichter, Bronislaw K.; Nov. 26, 2001; 29p; In English

Contract(s)/Grant(s): F19628-96-C-0063; AF Proj. 2823

Report No.(s): AD-A399288; AFRL-VS-TR-2001-1601; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document is the Final Report for the Compact Environmental Anomaly Sensor (CEASE) Flight Support Program carried out by AMPTEK, Inc. under Air Force contract F19628-96-C-0063. The goal of this program was to support the flight code development, functional testing, environmental testing, calibration spacecraft integration, and initial on-orbit checkout of the CEASE S/N 001 and S/N 002 instruments. These instruments were built by AMPTEK, Inc. under the Air Force contract F19628-90-C-0159. The basic instrument descriptions can be found in the final report for the previous contact. Under the current contract, AMPTEK Inc. supported the successful spacecraft specific design work, final calibration, and the delivery, integration, and launch of two CEASE instruments - S/N 001 onto the Space Test Research Vehicle 1c (STRV-1c) spacecraft and S/N 002 onto the Tri-Service Experiments (TSX-5) spacecraft. This report documents the work conducted by AMPTEK on these CEASE flight units and an accompanying engineering unit, under the current contract.

DTIC

*Anomalies; Detection; Environmental Tests; Warning Systems; Spacecraft Design*

## 15

### LAUNCH VEHICLES AND LAUNCH OPERATIONS

*Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also 18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.*

**20020040060** RAND Corp., Santa Monica, CA USA

#### **US Commercial Remote Sensing Satellite Industry: As Analysis of Risks**

OConnell, Kevin M.; Baker, John C.; Lachman, Beth E.; Berner, Steven; Frelinger, David; Jan. 2001; 135p; In English

Report No.(s): AD-A399253; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Since the advent of Earth observation satellites nearly four decades ago, governments have been the leading providers and users of satellite imagery data. However, this has recently changed as several U.S. and foreign companies have begun to acquire and launch their own imaging satellite systems. Some American firms are already operating their own imaging satellite systems (e.g., Orbimage's Orbview-2 and Space Imaging's IKONOS). These companies aim to become an important part of the U.S. commercial remote sensing industry, which today largely consists of aerial data providers and the value-added firms that play an important role in converting raw imagery data into the products desired by customers. Success for these new U.S. commercial remote sensing satellite firms heavily depends on both understanding and overcoming various risks (e.g., technical, market, policy and regulatory) that could diminish their prospects in the highly competitive global marketplace for geospatial information products and services. Within this context, U.S. government policies and regulations exert a major influence on the ability of U.S. remote sensing satellite firms to realize their competitive potential in both the domestic and international marketplaces.

DTIC

*Remote Sensing; Artificial Satellites; Satellite Imagery; Satellite Observation*

## 16

### SPACE TRANSPORTATION AND SAFETY

*Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information, see also 03 Air Transportation and Safety and 15 Launch Vehicles and Launch Vehicles, and 18 Spacecraft Design, Testing and Performance. For space suits, see 54 Man/System Technology and Life Support.*

**20020039332** NASA Goddard Space Flight Center, Greenbelt, MD USA

#### **Flight Computer Design for the Space Technology 5 (ST-5) Mission**

Speer, David, Northrop Grumman Electronic Systems, USA; Jackson, George, NASA Goddard Space Flight Center, USA; Raphael, Dave, NASA Goddard Space Flight Center, USA; [2001]; 16p; In English; 2002 IEEE Aerospace Conference, 9-16 Mar. 2002, Big Sky, MT, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): NAS5-99124

Report No.(s): IEEAC Paper-254; ISBN 0-7803-7231-X; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As part of NASA's New Millennium Program, the Space Technology 5 mission will validate a variety of technologies for nano-satellite and constellation mission applications. Included are: a miniaturized and low power X-band transponder, a constellation communication and navigation transceiver, a cold gas micro-thruster, two different variable emittance (thermal)

controllers, flex cables for solar array power collection, autonomous groundbased constellation management tools, and a new CMOS ultra low-power, radiation-tolerant, +0.5 volt logic technology. The ST-5 focus is on small and low-power. A single-processor, multi-function flight computer will implement direct digital and analog interfaces to all of the other spacecraft subsystems and components. There will not be a distributed data system that uses a standardized serial bus such as MIL-STD-1553 or MIL-STD-1773. The flight software running on the single processor will be responsible for all real-time processing associated with: guidance, navigation and control, command and data handling (C&DH) including uplink/downlink, power switching and battery charge management, science data analysis and storage, intra-constellation communications, and housekeeping data collection and logging. As a nanosatellite trail-blazer for future constellations of up to 100 separate space vehicles, ST-5 will demonstrate a compact (single board), low power (5.5 watts) solution to the data acquisition, control, communications, processing and storage requirements that have traditionally required an entire network of separate circuit boards and/or avionics boxes. In addition to the New Millennium technologies, other major spacecraft subsystems include the power system electronics, a lithium-ion battery, triple-junction solar cell arrays, a science-grade magnetometer, a miniature spinning sun sensor, and a propulsion system.

Author

*Computer Design; Flight Control; Airborne/Spaceborne Computers; Guidance (Motion); Transponders; Nanosatellites*

**20020039635** NASA Ames Research Center, Moffett Field, CA USA

**Thermal Protection Technology for Access to Space Vehicles**

Goldstein, Howard E., NASA Ames Research Center, USA; [1996]; 1p; In English, 4-9 Sep. 1996, Las Vegas, NV, USA  
Contract(s)/Grant(s): RTOP 242-20-01; No Copyright; Avail: Issuing Activity; Abstract Only

In the next century a new generation of space launch vehicles will be required to replace the Space Shuttle and the current expendable launch vehicle fleet. These new transportation systems must provide much lower lifecycle cost and mission versatility. In order to provide these attributes the vehicles must be designed with large operational margins of safety and weights comparable or lower than current systems. Advancements in Thermal Protection Systems (TPS) will be necessary to obtain these goals. This presentation will describe the thermal protection technology now under development by NASA that will be available for future Access to Space vehicles.

Author

*Launch Vehicles; Thermal Protection; Spacecraft Instruments*

## 17

### SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

*Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information, see also 04 Aircraft Communications and Navigation and 32 Communications and Radar.*

**20020039423** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

**Balloon/Parachute to Orbiter Communications Using a Dipole Antenna**

Kantak, Anil V., Jet Propulsion Lab., California Inst. of Tech., USA; Danos, Monika J., Jet Propulsion Lab., California Inst. of Tech., USA; December 2001; 78p; In English; Original contains color illustrations  
Contract(s)/Grant(s): NAS7-1407

Report No.(s): JPL-Publ-01-17; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Currently, quite a few missions are being studied to send satellites to the outer and inner planets and their moons of the solar system; a large percentage of these missions will have a landed element. NASA's Origins program, Solar System Exploration, Program and Sun Earth Connection (SEC) program, etc., will have a variety of spacecrafts to various solar system planets and their moons to sample and analyze the related atmospheres as well as the soil once the lander lands on the body. These sampling missions may involve a tender element sampling the atmosphere by performing experiments while descending into the atmosphere or a rover collecting samples to return to Earth or a station for experimentation on the planet surface. In either of these cases, the pertinent data generated will have to be sent to the Earth through a communication link. Communications with the Tender during the Entry, Decent and Landing (EDL) phases of a mission is of paramount importance. This article explores a particular method of passing through the atmosphere while communicating with the ground station (DSN station) before landing an instrument package (the lander) on the surface of the planet or moon of interest.

Author

*Dipole Antennas; Parachutes; Solar System; Balloon Flight; Communication Networks; Spacecraft Orbits*

**20020039526** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

**Radio Wave Propagation Handbook for Communication on and Around Mars**

Ho, Christian, Jet Propulsion Lab., California Inst. of Tech., USA; Golshan, Nasser, Jet Propulsion Lab., California Inst. of Tech., USA; Kliore, Arvydas, Jet Propulsion Lab., California Inst. of Tech., USA; Mar. 01, 2002; 116p; In English

Contract(s)/Grant(s): NAS7-1407

Report No.(s): JPL-Publ-02-5; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This handbook examines the effects of the Martian environment on radio wave propagation on Mars and in the space near the planet. The environmental effects include those from the Martian atmosphere, ionosphere, global dust storms, aerosols, clouds, and geomorphologic features. Relevant Martian environmental parameters were extracted from the measurements of Mars missions during the past 30 years, especially from Mars Pathfinder and Mars Global Surveyor. The results derived from measurements and analyses have been reviewed through an extensive literature search. The updated parameters have been theoretically analyzed to study their effects on radio propagation. This handbook also provides basic information about the entire telecommunications environment on and around Mars for propagation researchers, system engineers, and link analysts. Based on these original analyses, some important recommendations have been made, including the use of the Martian ionosphere as a reflector for Mars global or trans-horizon communication between future Martian colonies, reducing dust storm scattering effects, etc. These results have extended our wave propagation knowledge to a planet other than Earth; and the tables, models, and graphics included in this handbook will benefit telecommunication system engineers and scientific researchers.

Author

*Handbooks; Mars (Planet); Mars Environment; Radio Waves; Telecommunication; Wave Propagation; Mars Missions*

**18**

**SPACECRAFT DESIGN, TESTING AND PERFORMANCE**

*Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems, see 54 Man/System Technology and Life Support. For related information, see also 05 Aircraft Design, Testing and Performance, 39 Structural Mechanics, and 16 Space Transportation and Safety.*

**20020039136** NASA Glenn Research Center, Cleveland, OH USA

**Simulated Space Vacuum Ultraviolet (VUV) Exposure Testing for Polymer Films**

Dever, Joyce A., NASA Glenn Research Center, USA; Pietromica, Anthony J., Ohio Aerospace Inst., USA; Stueber, Thomas J., DYNACS Engineering Co., Inc., USA; Sechkar, Edward A., DYNACS Engineering Co., Inc., USA; Messer, Russell K., Cleveland State Univ., USA; January 2002; 14p; In English; 39th Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2001, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 755-1A-13

Report No.(s): NASA/TM-2002-211337; E-13148; NAS 1.15:211337; AIAA Paper 2001-1054; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Vacuum ultraviolet (VUV) radiation of wavelengths between 115 and 200 nm produced by the sun in the space environment can cause degradation to polymer films producing changes in optical, mechanical, and chemical properties. These effects are particularly important for thin polymer films being considered for ultra-lightweight space structures, because, for most polymers, VUV radiation is absorbed in a thin surface layer. NASA Glenn Research Center has developed facilities and methods for long-term ground testing of polymer films to evaluate space environmental VUV radiation effects. VUV exposure can also be used as part of sequential simulated space environmental exposures to determine combined damaging effects. This paper will describe the effects of VUV on polymer films and the necessity for ground testing. Testing practices used at Glenn Research Center for VUV exposure testing will be described including characterization of the VUV radiation source used, calibration procedures traceable to the National Institute of Standards and Technology (NIST), and testing techniques for VUV exposure of polymer surfaces.

Author

*Aerospace Environments; Far Ultraviolet Radiation; Spacecraft Structures; Thin Films; Environmental Tests; Polymeric Films*

**20020039293** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Development of the Variable Emittance Thermal Suite for the Space Technology 5 Microsatellite**

Douglas, Donya M., NASA Goddard Space Flight Center, USA; Swanson, Theodore, NASA Goddard Space Flight Center, USA; Osiander, Robert, Johns Hopkins Univ., USA; Champion, John, Johns Hopkins Univ., USA; Darrin, Ann Garrison, Johns Hopkins

Univ., USA; Biter, William, Sensortex, Inc., USA; Chandrasekhar, Prasanna, Ashwin-Ushas Corp., Inc., USA; [2001]; 8p; In English; Space Technology and Applications International Forum, 3-7 Feb. 2002, Albuquerque, NM, USA  
Report No.(s): Rept-154/A07; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The advent of very small satellites, such as nano and microsatellites, logically leads to a requirement for smaller thermal control subsystems. In addition, the thermal control needs of the smaller spacecraft/instrument may well be different from more traditional situations. For example, power for traditional heaters may be very limited or unavailable, mass allocations may be severely limited, and fleets of nano/microsatellites will require a generic thermal design as the cost of unique designs will be prohibitive. Some applications may require significantly increased power levels while others may require extremely low heat loss for extended periods. Small spacecraft will have low thermal capacitance thus subjecting them to large temperature swings when either the heat generation rate changes or the thermal sink temperature changes. This situation, combined with the need for tighter temperature control, will present a challenging situation during transient operation. The use of "off-the-shelf" commercial spacecraft buses for science instruments will also present challenges. Older thermal technology, such as heaters, thermostats, and heat pipes, will almost certainly not be sufficient to meet the requirements of these new spacecraft/instruments. They are generally too heavy, not scalable to very small sizes, and may consume inordinate amounts of power. Hence there is a strong driver to develop new technology to meet these emerging needs. Variable emittance coatings offer an exciting alternative to traditional control methodologies and are one of the technologies that will be flown on Space Technology 5, a mission of three microsatellites designed to validate "enabling" technologies. Several studies have identified variable emittance coatings as applicable to a wide range of spacecraft, and to potentially offer substantial savings in mass and/or power over traditional approaches. This paper discusses the development of the variable emittance thermal suite for ST-5. More specifically, it provides a description of and the infusion and validation plans for the variable emittance coatings.

Author

*Microsatellites; Temperature Control; Emittance; Spacecraft Instruments*

**20020039327** Lembaga Penerbangan dan Antariksa Nasional, Bidang Matahari dan Lingkungan Antariksa Puslitbang PI, Jakarta, Indonesia

**Earth and Space Environment's Impact Towards Satellites** *Lingkungan Bumi dan Antariksa Yang Berdampak Pada Satelit* Yatini, Clara Y., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Siahaan Mabe, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; October 2000; ISSN 0126-9754; Volume 2, No. 4, pp. 146-158; In Malay-Indonesian; Copyright; Avail: Issuing Activity

The near-Earth space and atmospheric environments influence not only the orbital elements of satellite, but also strongly influence the satellite's operational system. The plasma environment and high energy radiation come from solar radiation, solar wind, solar particle event, and cosmic rays can cause disturbances in orbital elements and differential charging of satellite component on the surface of the vehicle and disrupt the electronic component. These non-gravitational perturbations come from space and earth environment are associated with 11-year solar activity cycle.

Author

*Activity Cycles (Biology); Atmospheric Composition; Earth Environment; Orbital Elements; Solar Flares*

**20020039527** ATK-Thiokol Propulsion, Brigham City, UT USA

**Internal Flow Simulation of Enhanced Performance Solid Rocket Booster for the Space Transportation System**

Ahmad, Rashid A., ATK-Thiokol Propulsion, USA; [2001]; 43p; In English; 37th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 8-11 Jul. 2001, Salt Lake City, UT, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA  
Contract(s)/Grant(s): NAS8-38100

Report No.(s): AIAA Paper 2001-5236; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

An enhanced performance solid rocket booster concept for the space shuttle system has been proposed. The concept booster will have strong commonality with the existing, proven, reliable four-segment Space Shuttle Reusable Solid Rocket Motors (RSRM) with individual component design (nozzle, insulator, etc.) optimized for a five-segment configuration. Increased performance is desirable to further enhance safety/reliability and/or increase payload capability. Performance increase will be achieved by adding a fifth propellant segment to the current four-segment booster and opening the throat to accommodate the increased mass flow while maintaining current pressure levels. One development concept under consideration is the static test of a "standard" RSRM with a fifth propellant segment inserted and appropriate minimum motor modifications. Feasibility studies are being conducted to assess the potential for any significant departure in component performance/loading from the well-characterized RSRM. An area of concern is the aft motor (submerged nozzle inlet, aft dome, etc.) where the altered internal flow resulting from the performance enhancing features (25% increase in mass flow rate, higher Mach numbers, modified subsonic nozzle contour) may result in increased component erosion and char. to assess this issue and to define the minimum

design changes required to successfully static test a fifth segment RSRM engineering test motor, internal flow studies have been initiated. Internal aero-thermal environments were quantified in terms of conventional convective heating and discrete phase alumina particle impact/concentration and accretion calculations via Computational Fluid Dynamics (CFD) simulation. Two sets of comparative CFD simulations of the RSRM and the five-segment (IBM) concept motor were conducted with CFD commercial code FLUENT. The first simulation involved a two-dimensional axi-symmetric model of the full motor, initial grain RSRM. The second set of analyses included three-dimensional models of the RSRM and FSM aft motors with four-degree vectored nozzles.

Author

*Internal Flow; Computational Fluid Dynamics; Computerized Simulation; Solid Propellant Rocket Engines; Three Dimensional Models*

**20020039970** NASA Ames Research Center, Moffett Field, CA USA

**Integrated Design System (IDS) Tools for the Spacecraft Aeroassist/Entry Vehicle Design Process**

Olynick, David, NASA Ames Research Center, USA; Braun, Robert, NASA Langley Research Center, USA; [1997]; 1p; In English; Aeroassist Technology Workshop, 14-16 Jan. 1997, Pasadena, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The definition of the Integrated Design System technology focus area as presented in the NASA Information Technology center of excellence strategic plan is described. The need for IDS tools in the aeroassist/entry vehicle design process is illustrated. Initial and future plans for spacecraft IDS tool development are discussed.

Author

*Aeroassist; Spacecraft Design; Technology Utilization; Systems Integration*

## 19

### SPACECRAFT INSTRUMENTATION AND ASTRIONICS

*Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information, see also 06 Aircraft Instrumentation and Avionics; For spaceborne instruments not integral to the vehicle itself see 35 Instrumentation and Photography; For spaceborne telescopes and other astronomical instruments see 89 Astronomy, Instrumentation and Photography; For spaceborne telescopes and other astronomical instruments see 89 Astronomy.*

**20020039149** NASA Glenn Research Center, Cleveland, OH USA

**International Space Station Increment-2 Microgravity Environment Summary Report**

Jules, Kenol, NASA Glenn Research Center, USA; Hrovat, Kenneth, ZIN Technologies, Inc., USA; Kelly, Eric, ZIN Technologies, Inc., USA; McPherson, Kevin, NASA Glenn Research Center, USA; Reckart, Timothy, ZIN Technologies, Inc., USA; January 2002; 140p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 398-95-0G

Report No.(s): NASA/TM-2002-211335; E-13146; NAS 1.15:211335; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This summary report presents the results of some of the processed acceleration data, collected aboard the International Space Station during the period of May to August 2001, the Increment-2 phase of the station. Two accelerometer systems were used to measure the acceleration levels during activities that took place during the Increment-2 segment. However, not all of the activities were analyzed for this report due to time constraints, lack of precise information regarding some payload operations and other station activities. The National Aeronautics and Space Administration sponsors the Microgravity Acceleration Measurement System and the Space Acceleration Microgravity System to support microgravity science experiments, which require microgravity acceleration measurements. On April 19, 2001, both the Microgravity Acceleration Measurement System and the Space Acceleration Measurement System units were launched on STS-100 from the Kennedy Space Center for installation on the International Space Station. The Microgravity Acceleration Measurement System unit was flown to the station in support of science experiments requiring quasi-steady acceleration measurements, while the Space Acceleration Measurement System unit was flown to support experiments requiring vibratory acceleration measurement. Both acceleration systems are also used in support of vehicle microgravity requirements verification. The International Space Station Increment-2 reduced gravity environment analysis presented in this report uses acceleration data collected by both sets of accelerometer systems: 1) The Microgravity Acceleration Measurement System, which consists of two sensors: the Orbital Acceleration Research Experiment Sensor Subsystem, a low frequency range sensor (up to 1 Hz), is used to characterize the quasi-steady environment for payloads and the vehicle, and the High Resolution Accelerometer Package, which is used to characterize the vibratory environment up to

100 Hz. 2) The Space Acceleration Measurement System, which is a high frequency sensor, measures vibratory acceleration data in the range of 0.01 to 300 Hz. This summary report presents analysis of some selected quasisteady and vibratory activities measured by these accelerometers during Increment-2 from May to August 20, 2001.

Author

*Acceleration Measurement; Accelerometers; International Space Station; NASA Programs; Space Transportation System; Acceleration (Physics); Spaceborne Experiments*

**20020039156** Southwest Research Inst., USA

**Laboratory Experimentation Model of the 270 Degree Electron Tophat Analyzer *Final Report***

Frahm, R. A., Southwest Research Inst., USA; Sharber, J. R., Southwest Research Inst., USA; Link, R., Southwest Research Inst., USA; Winningham, J. D., Southwest Research Inst., USA; Feb. 28, 2002; 28p; In English; Original contains color illustrations Contract(s)/Grant(s): NAG5-8515; SwRI Proj. 15-02882; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of the most important space plasma measurements is that of a well-resolved low-energy (approx. 1 eV to 1 keV) electron spectrum. This range includes the regime where photoelectron and Auger processes are important [Winningham et al., 1989] as well as the very low-energy range (down to 1 eV) where electron distributions of temperature 11,000 K are measurable. Knowledge of the structure (approx. eV scale) of the photoelectron spectrum can provide information on the composition of a planetary or cometary atmosphere. As evidence, scientists developing the Analyzer of Space Plasma and Energetic Atoms (ASPERA-3) Electron Spectrometer (ELS) flying on the European Space Agency (ESA) Mars Express Mission have adapted their electron instrument to increase energy resolution in the photoelectron energy region as a means of remotely sensing the Martian atmosphere; the idea being that the Martian magnetic field is so weak that electron interaction between the source and point of detection is nonexistent; the measured electrons are therefore reflective of the processes occurring in the Martian atmosphere.

Derived from text

*Electron Scattering; Space Plasmas; Auger Effect; Electron Spectroscopy; Photoelectrons; Electron Distribution; Autoionization*

## 20

### SPACECRAFT PROPULSION AND POWER

*Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information, see also 07 Aircraft Propulsion and Power; 28 Propellants and Fuels; 15 Launch Vehicles and Launch Operations; and 44 Energy Production and Conversion.*

**20020039154** Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Penelitian Dasar Teknologi dan Uji Sistem, Jakarta, Indonesia

**Comparison of Runge Kutta and Adam Bashfort Moulton Solution Method in the Rocket Dynamic Equation *Perbandingan Solusi Metode Runge Kutta dan Metode Adams Bashfort Moulton Dalam Persamaan Gerak Roket***

Sembiring, Turah, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; October 2000; ISSN 0126-0480; Volume 2, No. 4, pp. 178-185; In Malay-Indonesian; Copyright; Avail: Issuing Activity

Runge Kutta and Adams Bashfort Moulton are the methods that can be used to find out the solution of differential equation with known boundary value conditions. by using these methods, the dynamic equation of ballistic rocket that shows differential equation system with boundary value conditions can be solved with numeric method. From the result of the rocket dynamic equations, the variables of these dynamic equations i.e : the horizontal distance, the height, the velocity, the angle of past fly and weight of rocket every time from the start 'flying up to drop down to the land can be found. by knowing the thrust, the burning time and elevation angle of rocket, the result of computation such as the maximum horizontal distance, the maximum height and the maximum velocity can be found. The result of the third methods such as Runge Kutta, Adams Bashfort Moulton methods and the rocket HR-3 methods can be compared. For maximum height and maximum velocity with Runge Kutta method the result are 63,5 km and 2,618 mach, with Adams Bashfort Moulton method the result are 59,48 km and 2,519 mach and with rocket HR-3 method are 68 km and 1,767 mach

Author

*Differential Equations; Dynamic Characteristics; Boundaries*

## CHEMISTRY AND MATERIALS (GENERAL)

*Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see categories 24 through 29. For astrochemistry see category 90 Astrophysics.*

**20020039303** Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan

**Practical Procedures for Hydrosilylation of Ketones and Silane-Induced Ring-Opening Polymerization of Cyclic Ethers by Prior Activation of the Cluster Catalyst by Hydrosilanes**

Matsubara, Kouki, Kyushu Univ., Japan; Iura, Takafumi, Kyushu Univ., Japan; Maki, Tomoyuki, Kyushu Univ., Japan; Terasawa, Jun-Ichi, Kyushu Univ., Japan; Nagashima, Hideo, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 2001; ISSN 0914-3793; Volume 15, No. 2, pp. 183-188; In English; Copyright; Avail: Issuing Activity

Pre-activation of ( $\mu_2, \eta^2: \eta^3: \eta^5$ -acenaphthylene)  $\text{Ru}_3(\text{CO})_7$  (1) by hydrosilanes in a small amount of dioxane provides novel convenient and useful procedures for hydrosilylation of carbonyl compounds and silane-induced ring-opening polymerization of cyclic ethers and a cyclic siloxane. The initial step of the catalytic cycle was investigated by NMR detection of products formed by the oxidative addition of hydrosilanes to 1. A possibility for the involvement of cluster species in the catalytic cycle is discussed.

Author

*Ethers; Ketones; Silanes; Polymerization*

**20020040065** Aerospace Corp., Lab. Operations, El Segundo, CA USA

**Combustion of Nitrogen in Low-Pressure  $\text{H}_2 + \text{O}_2$  and  $\text{H}_2 + \text{CO} + \text{O}_2$  Flames**

Sheaffer, P. M.; Zittel, P. F.; Nov. 30, 2001; 29p; In English; Original contains color images

Contract(s)/Grant(s): F04701-00-C-0009

Report No.(s): AD-A399226; TR-2001(1306)-4; SMC-TR-02-09; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Among other tools, the Air Force employs computer models of the chemistry in afterburning rocket plumes to assess the environmental impact of rocket launches on the upper atmosphere and, in particular, the ozone layer. To improve the accuracy of these models, it is necessary to verify the chemical mechanisms and reaction rate constants used in the models. One method by which verification can be achieved is by comparing the results of laboratory flame measurements with model predictions of combustion products. Nitrogen is present in the atmosphere at all altitudes and is entrained with oxygen into the afterburning exhaust plume of a rocket motor as it rises through the troposphere and lower stratosphere. In the laboratory, we have examined the low-pressure combustion of nitrogen-doped  $\text{H}_2 + \text{O}_2$  and  $\text{H}_2 + \text{CO} + \text{O}_2$  flames. The experiments were carried out at a pressure of 50 Torr, simulating rocket plume afterburning conditions at 20 km altitude. The cool, post-flame combustion products were analyzed with a mass spectrometer and a specially modified NO(x), chemiluminescence analyzer, as the stoichiometry of the flame was varied to simulate the range of afterburning mixtures encountered in a real rocket plume. Comparisons of the experimental results with preliminary computer flame simulations are used to test the accuracy of the chemical mechanisms employed in modeling nitrogen combustion at low pressures.

DTIC

*Afterburning; Combustion; Combustion Products; Computerized Simulation; Flames; Plumes; Reaction Kinetics; Nitrogen Oxides*

**20020040363** Federal Aviation Administration, William J. Hughes Technical Center, Atlanta, GA USA

**Flammability of Automotive Child Restraint Seats for Use in Aircraft**

Johnson, Richard; Wuethrich, Lindsey; Nov. 2001; 25p; In English

Report No.(s): AD-A399321; DOT/FAA/AR-TN01/42; AAR-422; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Child restraint seat used in aircraft are based on automotive designs that are required to pass a horizontal bum rate test method. The flammability of child seat materials was gauged against the Federal Aviation Administration (FAA) vertical Bunsen burner tests method. Basically, the vertical test prescribed in Federal Aviation Regulation (FAR) 25.853 (a)(1)(II) allows a bum length of 8 inches and flame time of 15 seconds after exposure to a Bunsen burner flame for 12 seconds. Eight child restraint seats were purchased from a retail store. The seats were disassembled in order to cut test specimens from the various seat components. Because of the size of the seat and use of materials, in most cases it was not possible to prepare the required sample size and replicates. However, this did not impact the overall conclusions regarding the flammability of the materials tested. The test results indicated that the large majority of materials would not meet the FAA vertical fire test criteria. Also, some of the failed materials

burned across the entire sample length, and others produced high flames or dense smoke. The findings are consistent with the knowledge that a horizontal bum test is far less severe than a vertical bum test.

DTIC

*Burners; Constraints; Exposure; Flammability; Seats; Flame Retardants*

**20020040774** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

**Moisture Distribution and Flow During Drying of Wood and Fiber**

Zink-Sharp, A.; Hanna, R. B.; Dec. 28, 2001; 112p; In English

Report No.(s): DE2002-789798; DOE/ID/13537; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

New understanding, theories, and techniques for moisture flow and distribution were developed in this research on wood and wood fiber. Improved understanding of the mechanisms of flake drying has been provided. Observations of flake drying and drying rate curves revealed that rate of moisture loss consisted of two falling rate periods and no constant rate drying period was observed. Convective heat transfer controls the first period, and bound water diffusion controls the second period. Influence of lower drying temperatures on bending properties of wood flakes was investigated. Drying temperature was found to have a significant influence on bending stiffness and strength. A worksheet for calculation of the energy required to dry a single strandboard flake was developed but has not been tested in an industrial setting yet. A more complete understanding of anisotropic transverse shrinkage of wood is proposed based on test results and statistical analysis. A simplified model of a wood cell's cross-section was drawn for calculating differential transverse shrinkage. The model utilizes cell wall thickness and microfibrillar packing density and orientation. In spite of some phenomena of cell wall structure not yet understood completely, the results might explain anisotropic transverse shrinkage to a major extent. Boundary layer theory was found useful for evaluating external moisture resistance during drying. Simulated moisture gradients were quite comparable to the actual gradients in dried wood. A mathematical procedure for determining diffusion and surface emission coefficients was also developed. Thermal conductivity models of wood derived from its anatomical structure were created and tested against experimental values. Model estimations provide insights into changes in heat transfer parameters during drying. Two new techniques for measuring moisture gradients created in wood during drying were developed. A new technique that utilizes optical properties of cobalt chloride was developed for nondestructive determination of surface moisture content. Fundamental new understanding of drying characteristics in wood and fiber has been provided that can be used by researchers to improve drying of wood and fiber. The three techniques for measuring moisture content and gradients provided in this study are efficient, practical, and economical - easy to apply by industry and researchers. An energy consumption worksheet is provided as a first step toward reducing energy consumed during drying of lumber and strandboard flakes. However, it will need additional verification and testing.

NTIS

*Drying; Moisture Content; Wood; Fibers; Thermal Conductivity; Water Flow*

**20020040814** Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

**Determining Extent of Ion-Exchange in Various Counterion Nafion Membranes Using Prompt Gamma Neutron Activation Analysis (PGAA) Final Report, Jun. 1999-Mar. 2001**

Young, Sandra K.; Trevino, Samuel F.; Tan, Nora C.; Paul, Rick L.; Mar. 2002; 36p; In English

Report No.(s): AD-A399696; ARL-TR-2679; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Researchers have performed structural evaluations on Nafion membranes for many years. Various research groups have published a large volume of data; however, much of the work done by these groups is contradictory. One important aspect of the membranes is the chemical uniformity and quantity of water within the membrane under investigation. A new technique that has shown its usefulness for providing accurate and fast quantitative measurements of chemical composition quickly is prompt gamma neutron activation analysis (PGAA). In this work, a sulfonyl fluoride-form membrane, an as-received membrane from the manufacturer, and several differently pretreated H(+)-form Nafion membranes were examined using PGAA. The evaluation showed the necessity for pretreatment of membranes to eliminate contamination. A series of counterion-exchanged membranes were also examined to determine maximum conversion achieved and to identify possible limitations to complete conversion. The results show that it is possible to obtain nearly complete or complete conversion to the counterion from the H(+)-form Nafion samples. Water content can be limited within the membrane but not eliminated. In samples that were not pretreated, complete ion exchange was limited by the contamination.

DTIC

*Chemical Composition; Membranes; Fluorides; Ion Exchanging*

**20020040830** National Renewable Energy Lab., Golden, CO USA

**Recent Progress in CIGS Thin Film Solar Cell Research at NREL: Preprint**

Ramanathan, K.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000021; NREL/CP-520-31013; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: This paper summarizes our work toward improving reproducibility in fabricating high efficiency absorbers and devices.

NTIS

*Solar Cells; Fabrication*

**24**

**COMPOSITE MATERIALS**

*Includes physical, chemical, and mechanical properties of laminates and other composite materials.*

**20020039312** Department of the Navy, Washington, DC USA

**Method and System for Production of Fibrous Composite Prototypes Using Acoustic Manipulation in Stereolithography**

Koch, Robert M., Inventor; Kuklinski, Robert, Inventor; Jun. 08, 2001; 22p; In English

Patent Info.: Filed 8 Jun. 2001; US-Patent-Appl-SN-09876372

Report No.(s): AD-D019992; No Copyright; Avail: Defense Technical Information Center (DTIC)

A method for producing a three-dimensional object by stereolithography. A solid reinforcing material is mixed with the fluid medium so that at least a part of said solid reinforcing medium is located in the layer of the fluid medium between the top surface of the most recently formed lamina and the top surface of the fluid medium. An acoustic field is then established in the fluid medium such that this acoustic field exists in at least part of the layer of the fluid medium between the top surface of the most recently formed lamina and the top surface of the fluid medium. The solid reinforcing material is thereby moved with said acoustic force field. A three-dimensional reinforced object is thereby produced.

DTIC

*Patent Applications; Fiber Composites; Lithography; Three Dimensional Composites*

**20020039723** Florida Univ., Dept. of Aerospace Engineering, Mechanics and Engineering Science, Gainesville, FL USA

**Analysis Methods for Functionally Graded Materials and Structures *Final Report, 1 Jun. - 31 Dec. 2001***

Sankar, Bhavani V., Florida Univ., USA; Mar. 29, 2002; 38p; In English

Contract(s)/Grant(s): NAG1-01088; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Weight savings offered by sandwich constructions for structures that require high bending stiffness are significant. However, sandwich constructions have not been fully exploited in structural applications due to damage tolerance concerns. The core/face sheet lamination is a major concern in sandwich laminate construction. The stiffness discontinuity at the face sheet and core interface results in a large increase in shear stresses. While the core material itself can withstand very high shear stresses, the bond (or adhesive layer) at the interface relatively weaker. It is believed that the stress concentration can be controlled by varying (functionally grading) the core properties through the thickness. Functionally graded materials (FGMs) possess properties that vary gradually with location within the material. For example, a rocket motor casing can be made with a material system such that the inside is made of a refractory material, the outside is made of a strong metal, and the transition from the refractory material to the metal is gradual through the thickness. FGMs differ from composites: the volume fraction of the inclusion is uniform throughout the composite. The closest analogies of FGMs are laminated composites, but they possess distinct interfaces across which properties change abruptly. Although fabrication technology of FGMs is in its infancy, they offer many advantages. Suresh and Mortensen provide an excellent introduction to FGMs. As the use of FGMs increases, in aerospace, automotive and biomedical applications for example, new methodologies have to be developed to characterize them, and to design and analyze structural components made with these materials. The methods should be such that they can be incorporated into available methods with minimal modifications, if any. One problem is that of response of FGMs to thermo-mechanical loads. Although FGMs are highly heterogeneous, it will be useful to idealize them as continua with properties that change smoothly with respect to spatial coordinates. This will enable closed-form solutions to be obtained for some fundamental solid mechanics problems, and will aid the development of finite element models for structures made of FGMs.

Derived from text

*Sandwich Structures; Structural Design; Stress Concentration; Fabrication; Construction*

**20020040073** Army Research Lab., Aberdeen Proving Ground, MD USA

**Measurement of V50 Behavior of a Nylon 6-Based Polymer-Layered Silicate Nanocomposite** *Final Report, Jun.-Aug. 2000*  
Ostermayer, David; Beyer, Frederick L.; Dehmer, Peter G.; Klusewitz, Melissa A.; Sep. 2001; 36p; In English; Prepared in collaboration with University of Delaware, Newark

Report No.(s): AD-A399371; ARL-TR-2605; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The performance under ballistic impact conditions of a nylon 6-based polymer-layered silicate (PLS) nanocomposite was examined using a V50 test. The commercially available nanocomposites contained approximately 2.5-wt.% montmorillonite clay mineral and were fabricated by in situ polymerization of epsilon-caprolactam in the presence of an organosilicate clay mineral. The velocity at which 50% of 0.22-cal. fragment simulator projectiles penetrated the unmodified nylon 6 and 0.5-mm aluminum witness plate (V50) was determined to be 436 ft/s. The PLS nanocomposite nylon 6-clay hybrid was found to have a V50 of 338 ft/s. Therefore, it was found that the addition of the layered silicate clay mineral filler did not improve the impact properties of nylon 6 under these conditions.

DTIC

*Composite Materials; Terminal Ballistics; Impact Resistance; Nanocomposites; Impact Strength*

**20020040079** Syracuse Univ., NY USA

**A Predictive Methodology for Delamination Growth in Laminated Composites Growth in Laminated Composites. Part 2. Analysis, Applications, and Accuracy Assessment** *Final Report*

Davidson, Barry D.; Oct. 2001; 126p; In English

Contract(s)/Grant(s): 94-G-022

Report No.(s): AD-A399377; DOT/FAA/AR-01/56; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A nonclassical, energy release rate-based approach to predict delamination growth is described that overcomes the limitations of current, state-of-the art methodologies. First, two- and three-dimensional crack-tip elements are introduced. When a classical, singular field-based mode decomposition procedure is used, the crack-tip elements are shown to predict the same values of energy release rate and mode mixity as two- and three-dimensional continuum finite element analyses for a wide variety of geometries, materials, lay-ups and loadings, including stiffened-skin construction typical to that used in aircraft construction. However, the crack tip element (CTE) analyses are considerably simpler and require orders of magnitude less development and execution time. Next, it is demonstrated that the CTE analyses may also be used to decompose the total energy release rate into nonclassical mode I, II, and III components. This nonsingular field (NSF) decomposition may be used, along with toughness versus mode mix data obtained from unidirectional laminates with midplane delaminations, to predict delamination growth with considerably better accuracy than the classical, state-of-the-art approach. This is due to the fact that the near-tip damage zone is sufficiently large in polymeric matrix composites to invalidate the classical assumptions, whereas the NSF mode decomposition is constructed in a manner that is insensitive to the details of this local damage state. This is demonstrated by applying both the classical and CTE/NSF approaches to make delamination growth predictions in four different graphite-reinforced composites, with matrices that include an epoxy, a toughened epoxy, a thermoplastic interlayer toughened epoxy, and a thermoplastic. For this portion of the study, only flat plate geometries were considered.

DTIC

*Composite Materials; Laminates; Polymer Matrix Composites; Aircraft Structures; Graphite*

**20020040125** Hope Coll., Dept. of Physics and Engineering, Holland, MI USA

**Theoretical Investigation of Thermo-Mechanical Behavior of Carbon Nanotube-Based Composites Using the Integral Transform Method**

Pawloski, Janice S., Hope Coll., USA; [2001]; 7p; In English; Original contains color illustrations

Report No.(s): NRA-99-05-OSS-0897; NLPN-01-0022; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This project uses the integral transform technique to model the problem of nanotube behavior as an axially symmetric system of shells. Assuming that the nanotube behavior can be described by the equations of elasticity, we seek a stress function  $\chi$  which satisfies the biharmonic equation:  $\nabla^4 \chi = [\text{partial deriv}(r(\exp 2)) + \text{partial deriv}(r) + \text{partial deriv}(z(\exp 2))] \chi = 0$ . The method of integral transformations is used to transform the differential equation. The symmetry with respect to the z-axis indicates that we only need to consider the sine transform of the stress function:  $X(\bar{r})(r, \zeta) = \int_0^\infty \chi(r, z) \sin(\zeta, z) dz$ .

Author

*Carbon Nanotubes; Integral Transformations; Stress Functions; Numerical Analysis*

## INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

*Includes the analysis, synthesis, and use inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see also 34 Fluid Dynamics and Thermodynamics, For astrochemistry see category 90 Astrophysics.*

**20020039301** Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan

**Valence-Isomerization Reaction of Quadricyclane to Norbornadiene Promoted by Lithium TFPB**

Ikeda, Shin-Ya, Kyushu Univ., Japan; Sonoda, Takaaki, Kyushu Univ., Japan; Mori, Akira, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 2001; ISSN 0914-3793; Volume 15, No. 2, pp. 177-181; In Japanese; Copyright; Avail: Issuing Activity

Thermally-forbidden reactions of quadricyclane to norbornadiene were accelerated by a catalytic amount of alkaline salts, where the presence of water and the nature of the counter anion and solvent affected the rate. Non-hydrated, highly electrophilic lithium ions obtained from Lithium tetrakis(3,5-bis (trifluoromethyl)phenyl) borate (LiTFPB) promotes the valence-isomerization of quadricyclane to norbornadiene extremely; the relative rates in the presence of LiTFPB, LiTFPB H<sub>2</sub>O, and NaTFPB are 470:76:2.7 in CDCl<sub>3</sub> and 297:9.7:1 in C<sub>6</sub>D<sub>5</sub>CD<sub>3</sub>. This is explained by the difference of the binding energy of lithium and sodium ion. The rates in CDCl<sub>3</sub> are higher than those in C<sub>6</sub>D<sub>5</sub>CD<sub>3</sub> which is supported by theoretical calculations.

Author

*Lithium; Metal Ions; Binding Energy; Catalytic Activity*

**20020039323** Kyushu Univ., Dept. of Energy and Environmental Engineering, Kasuga, Japan

**Measurements of Thermal Conductivity and Thermal Diffusivity of Molten Carbonates**

Wicaksono, Hendro, Kyushu Univ., Japan; Zhang, Xing, Kyushu Univ., Japan; Fujiwara, Seiji, Kyushu Univ., Japan; Fujii, Motoo, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 2001; ISSN 0914-3793; Volume 15, No. 2, pp. 165-167; In English; Copyright; Avail: Issuing Activity

The thermal conductivity and thermal diffusivity of molten carbonates (Li<sub>2</sub>CO<sub>3</sub>/K<sub>2</sub>CO<sub>3</sub> and Li<sub>2</sub>CO<sub>3</sub>/Na<sub>2</sub>CO<sub>3</sub>) were measured using the transient short-hot-wire method in the temperature range from 530 to 670 C. Two types of probes were examined. One was a platinum short-hot-wire probe coated with alumina (Al<sub>2</sub>O<sub>3</sub>) thin film to prevent current leakage and corrosion. The other was a bare gold short-hot-wire probe. For the platinum probe, the quality of coating reduces gradually during the measurements of molten carbonates due to their high corrosiveness. The quality reduction has caused relatively large errors of measured thermal conductivity and thermal diffusivity around +/- 10 and +/- 40 respectively. For the bare gold probe, the corrosion due to electro-chemical reaction can be neglected and the effect of current leakage into the molten carbonates can be estimated. Then the temperature dependency of the electrical resistivity was calibrated accurately and compared with existing data. by using this gold probe without coating on the hot wire surface, the thermal conductivity and thermal diffusivity of molten carbonates can be measured within errors of +/- 3 and +/- 9%, respectively. It is further confirmed that the gold probe can be used repeatedly without the reduction of quality.

Author

*Carbonates; Thermal Conductivity; Thermal Diffusivity; Wire; Gold*

**20020039615** NASA Kennedy Space Center, Cocoa Beach, FL USA

**Membrane Separation Processes at Low Temperatures**

Parrish, Clyde, NASA Kennedy Space Center, USA; [2002]; 11p; In English; 40th Aerospace Science Meeting and Exhibit, 14-17 Jan. 2002, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): NASA/TP-2002-210266; NAS 1.60:210266; AIAA Paper 2002-0461; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary focus of Kennedy Space Center's gas separation activities has been for carbon dioxide, nitrogen, and argon used in oxygen production technologies for Martian in-situ resource utilization (ISRU) projects. Recently, these studies were expanded to include oxygen for regenerative life support systems. Since commercial membrane systems have been developed for separation of carbon dioxide, nitrogen, and oxygen, initially the studies focused on these membrane systems, but at lower operating temperatures and pressures. Current investigations are examining immobilized liquids and solid sorbents that have the potential for higher selectivity and lower operating temperatures. The gas separation studies reported here use hollow fiber membranes to separate carbon dioxide, nitrogen, and argon in the temperature range from 230 to 300 K. Four commercial membrane materials were used to obtain data at low feed and permeate pressures. These data were used with a commercial solution-diffusion modeling tool to design a system to prepare a buffer gas from the byproduct of a process to capture Martian carbon dioxide. The system

was designed to operate, at 230 K with a production rate 0.1 sLpm; Feed composition 30% CO<sub>2</sub>, 44% N<sub>2</sub>, and 26% Ar; Feed pressure 104 kPa (780); and Permeate pressure 1 kPa (6 torr); Product concentration 600 ppm CO<sub>2</sub>. This new system was compared with a similar system designed to operate at ambient temperatures (298 K). The systems described above, along with data, test apparatus, and models are presented.

Author

*Low Temperature; Gas Mixtures; Membranes; Systems Engineering; Permeability; Gas Chromatography; Mars (Planet)*

**20020039739** NASA Ames Research Center, Moffett Field, CA USA

**Feature Profile Evolution of SiO<sub>2</sub> Trenches In Fluorocarbon Plasmas**

Hwang, Helen, NASA Ames Research Center, USA; Govindan, T. R., NASA Ames Research Center, USA; Meyyappan, M., NASA Ames Research Center, USA; Arunachalam, Valli, Motorola, Inc., USA; Rauf, Shahid, Motorola, Inc., USA; Coronell, Dan, Motorola, Inc., USA; [1999]; 1p; In English; 46th International Symposium of American Vacuum Society International Symposium, Oct. 1999, Seattle, WA, USA

Contract(s)/Grant(s): NAS2-14031; RTOP 632-10-01; No Copyright; Avail: Issuing Activity; Abstract Only

Etching of silicon microstructures for semiconductor manufacturing in chlorine plasmas has been well characterized. The etching proceeds in a two-part process, where the chlorine neutrals passivate the Si surface and then the ions etch away SiCl<sub>x</sub>. However, etching in more complicated gas mixtures and materials, such as etching of SiO<sub>2</sub> in Ar/C<sub>4</sub>F<sub>8</sub>, requires knowledge of the ion and neutral distribution functions as a function of angle and velocity, in addition to modeling the gas surface reactions. In order to address these needs, we have developed and integrated a suite of models to simulate the etching process from the plasma reactor level to the feature profile evolution level. This arrangement allows for a better understanding, control, and prediction of the influence of equipment level process parameters on feature profile evolution. We are currently using the HPEM (Hybrid Plasma Equipment Model) and PCMCM (Plasma Chemistry Monte Carlo Model) to generate plasma properties and ion and neutral distribution functions for argon/fluorocarbon discharges in a GEC Reference Cell. These quantities are then input to the feature scale model, Simulation of Profile Evolution by Level Sets (SPELS). A surface chemistry model is used to determine the interaction of the incoming species with the substrate material and simulate the evolution of the trench profile. The impact of change of gas pressure and inductive power on the relative flux of CF<sub>x</sub> and F to the wafer, the etch and polymerization rates, and feature profiles will be examined. Comparisons to experimental profiles will also be presented.

Author

*Fluorocarbons; Plasmas (Physics); Silicon Dioxide; Mathematical Models; Polymerization*

**20020039747** NASA Ames Research Center, Moffett Field, CA USA

**Detection of Chamber Conditioning by CF<sub>4</sub> in the GEC Cell**

Cruden, Brett A., NASA Ames Research Center, USA; Rao, M. V. V. S., NASA Ames Research Center, USA; Sharma, S. P., NASA Ames Research Center, USA; Meyyappan, M., NASA Ames Research Center, USA; [2001]; 1p; In English

Contract(s)/Grant(s): RTOP 632-62-01; No Copyright; Avail: Issuing Activity; Abstract Only

During oxide etch processes, buildup of fluorocarbon residues on reactor sidewalls can cause to drift and will necessitate time for conditioning and cleaning of the reactor. Various measurements in CF<sub>4</sub> and Ar plasmas are made in an attempt to identify a metric able to indicate the chamber condition. Mass spectrometry and a Langmuir probe shows that the buildup of fluorocarbon films on the reactor surface causes a decrease in plasma floating potential, plasma potential, and ion energy in argon plasmas. This change in floating potential is also observed in CF<sub>4</sub> plasma operation, and occurs primarily during the first hour and a half of plasma operation. A slight rise in electron density is also observed in the argon plasmas. Because the change is seen in an argon plasma, it is indicative of altered physical, not chemical, plasma-surface interactions. Specifically, the insulating films deposited on metal surfaces alter the electromagnetic fields seen by the plasma, affecting various parameters including the floating potential and electron density. An impedance probe placed on the inductive coil shows a slight reduction in plasma impedance due to this rising electron density. The optical emission of several species, including CF, C<sub>2</sub>, atomic Si and atomic C, is also monitored for changes in density resulting from the buildup of film on the chamber wall. Changes in the optical emission spectrum are comparable to the noise levels in their measurement.

Author

*Detection; Fluorocarbons; Chambers; Argon Plasma; Electromagnetic Fields*

**20020039812** NASA Ames Research Center, Moffett Field, CA USA

**Infrared Spectra of Perdeuterated Naphthalene, Phenanthrene, Chrysene, and Pyrene**

Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; Langhoff, Stephen R., NASA Ames Research Center, USA; Sandford, Scott A., NASA Ames Research Center, USA; Hudgins, Douglas M., Adrian Coll., USA; [1996]; 1p; In English  
Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

Calculations are carried out using density functional theory (DFT) to determine the harmonic frequencies and intensities of perdeuterated naphthalene, phenanthrene, pyrene, and chrysene. We also report matrix- isolation spectra for these four species. The theoretical and experimental frequencies and relative intensities for the perdeuterated species are in generally good agreement. The effect of perdeuteration is to reduce the sum of the integrated intensities by a factor of about 1.75. This reduction occurs for all vibrational motions, except for the weak low frequency ring deformation modes. There is also a significant redistribution of the relative intensities between the out-of-plane C-D bands relative to those found for the out-of-plane C-H bands. The theoretical isotopic ratios provide an excellent diagnostic of the degree of C-H(C-D) involvement in the vibrational bands, allowing in most cases a clear distinction of the type of motion.

Author

*Naphthalene; Phenanthrene; Low Frequencies; Vibration; Infrared Spectra; Deformation; Pyrenes*

**20020039824** NASA Ames Research Center, Moffett Field, CA USA

**Effective Potential Energies and Transport Properties for Nitrogen and Oxygen**

Stallcop, James R., NASA Ames Research Center, USA; Partridge, Harry, NASA Ames Research Center, USA; Levin, Eugene, NASA Ames Research Center, USA; [2001]; 1p; In English

Contract(s)/Grant(s): RTOP 725-10-61; No Copyright; Avail: Issuing Activity; Abstract Only

The results of recent theoretical studies for N--N<sub>2</sub>, O--O<sub>2</sub>, N<sub>2</sub>--N<sub>2</sub> interactions are applied to the transport properties of nitrogen and oxygen gases. The theoretical results are used to select suitable oxygen interaction energies from previous work for determining the diffusion and viscosity coefficients at high temperatures. A universal formulation is applied to determine the collision integrals for O<sub>2</sub>--O<sub>2</sub> interactions at high temperatures and to calculate certain ratios for determining higher-order collision integrals.

Author

*Potential Energy; Transport Properties; Oxygen; Nitrogen; Collisions*

**20020039848** Prins Maurits Lab. TNO, Rijswijk, Netherlands

**The Third NATO/SIBCRA Training Exercise on the Identification of Potential Mid-Spectrum Agents *Final Report Derde NATO/SIBCRA Oefening in Identificatie Van Toxinen***

vanBaar, B. L. M., Prins Maurits Lab. TNO, Netherlands; deJong, A. L., Prins Maurits Lab. TNO, Netherlands; Hulst, A. G., Prins Maurits Lab. TNO, Netherlands; Wils, E. R. J., Prins Maurits Lab. TNO, Netherlands; November 2001; 29p; In English; Original contains color illustrations

Contract(s)/Grant(s): A93/KL/424; TNO Proj. 014.12825

Report No.(s): TD-2001-0065; PML-2001-A65; Copyright; Avail: Issuing Activity

The TNO Prins Maurits Laboratory (TNO-PML) participated in the third NATO/SIBCRA training exercise on the identification of potential mid-spectrum agents (MSA). The exercise, coordinated by Canada, was conducted in February 2001. The objective of the exercise was the identification of two potential MSA spiked onto soil samples. The identification of the two MSA by TNO-PML was performed by employing a combined approach of matrix-assisted laser desorption/ionization (MALDI) mass spectrometry (MS) and liquid chromatography (LC) electrospray (ES) MS. The analyses were carried out with a progressive degree of certainty of identification in accordance with the NATO/SIBCRA identification criteria for MSA, from 'provisional' to 'confirmed' to 'unambiguous'. One test compound was unambiguously identified as Ochratoxin A (CAS number [303-47-9]), a non-peptide toxin, whereas the other was unambiguously identified as Ile-Ser-Bradykinin (CAS number [86030-63-9]), a peptide toxin. All analyses were successfully completed within five working days and the identification was concluded by comparison of the analytical data of the test compounds to those of authentic standards.

Author

*North Atlantic Treaty Organization (NATO); Toxins and Antitoxins; Biological Weapons; Education; Spectroscopic Analysis*

**20020040056** Iowa State Univ. of Science and Technology, Dept. of Chemistry, Ames, IA USA  
**Theoretical Studies of Silicon and Related Elements Final Report, 1 Jan. 1998-31 Dec. 2001**

Gordon, Mark S.; Feb. 19, 2002; 19p; In English

Contract(s)/Grant(s): F49620-98-1-0164; Proj-2303

Report No.(s): AD-A399373; AFRL-SR-BL-TR-02-0062; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On the theoretical side, a new highly scalable code for frozen core second order perturbation theory gradients for closed shell molecules has been developed. The development of analogous codes for molecules with unpaired electrons is in progress. A sequential unrestricted code for this purpose has been completed. The derivation for the spin-restricted open shell second order perturbation theory gradients has been completed, and a paper describing this derivation has now been accepted. Other important developments are new convergence methods for MCSCF wave functions that facilitate MCSCF calculations on large molecules, the derivation of gradients for multi-reference second order perturbation theory, the development and implementation of a full-CI method that is amenable to parallelization, further developments of our effective fragment potential (EFP) method for studying solvation and liquid behavior, the development of molecular dynamics and Monte Carlo methods to facilitate the study of solvation and liquid behavior, the development and implementation of a new method for producing global potential energy surfaces from sets of ab initio points, the development and implementation of both grid-based and gridless approaches to density functional theory, and the development and implementation of several MCSCF-based approaches to spin-orbit coupling. With regard to applications, considerable progress has been made in our understanding of the mechanisms for formation of POSS (polyhedral oligomeric silsesquioxanes) and the possibility of passing small gas molecules through them. POSS titanium analogs have also been studied, as have the hydrosilation and bis-silylation reactions. Other applications include studies of surface chemistry, several silicon systems and studies of the behavior of water clusters.

DTIC

*Silicon; Chemical Reactions; Perturbation Theory; Surface Reactions*

**20020040089** Johns Hopkins Univ., Chemical Propulsion Information Agency, Columbia, MD USA  
**Solid Propellant Subscale Burning Rate Analysis Methods for US and Selected NATO Facilities**

Fry, R. S.; Jan. 2002; 256p; In English

Contract(s)/Grant(s): SPO700-97-D-4004

Report No.(s): AD-A399211; CPTR-75; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Current methods used within the NATO community for analyzing small motor burning rate test data are reviewed and recommendations are made to support improved prediction of internal ballistics of a full-scale solid propellant motor. The NATO Research and Technology Organization (RTO), Advanced Vehicle Technology (AVT), Working Group (WG) 016 (formerly AGARD/PEP Working Group #27) undertook to evaluate methods used within the NATO propulsion community to measure burning rate in solid propellant rocket systems, with the purpose of identifying similarities and differences between the member nations. This WG was formed in 1996, consisting of representatives from 6 of the 15 member nations of NATO, with inputs accepted from 4 other member nations and a couple non-member nations. The NATO RTO/AVT WG 016 sought to contribute to improvements in the burning rate tools to address issues that have plagued the solid propulsion industry for over 40 years: (1) Better understanding of burning rate data from various facilities to ease the comparison of propellants from various manufacturers and to improve international exchanges and cooperation; (2) Better accuracy and reliability of measurements allowing a decrease in the number of tests (and associated time and cost) and an improved control of manufacturing and aging. Simulated and real subscale rocket motor data were used to evaluate the two fundamentally different families of burning rate analysis methods. While organizational preferences generally dictate method usage, surveys indicate a trend toward methods that more effectively account for non-ideal tailoff, favoring improved accuracy. Consistency in these definitions would promote ease in correlating data internationally. Further development of the Hessler-Glick method shows promise. The NATO propulsion community is urged to review these findings as a means of advancing their own burning rate measurement and analysis methods.

DTIC

*Solid Propellants; Burning Rate; Solid Propellant Rocket Engines; Interior Ballistics*

**20020040102** Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA  
**Direct Deposition of Low Resistance Thermally Stable Ohmic Contacts to n-SiC Final Report, May 2000-Nov. 2001**

Cole, M. W.; Joshi, P. C.; Ervin, M. H.; Demaree, J. D.; Wood, M. C.; Jun. 2001; 26p; In English

Report No.(s): AD-A399248; ARL-TR-2534; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ni<sub>2</sub>Si Ohmic contacts were fabricated via pulsed laser deposition on n-SiC. The contacts' electrical, structural, compositional, and surface morphological properties were investigated as a function of annealing temperatures ranging from 700 to 950 deg C. The as-deposited and 700 deg C annealed contacts were non-Ohmic. Annealing at 950 deg C yielded excellent Ohmic

behavior, an abrupt void-free interface, and a smooth surface morphology. No residual carbon was present within the contact metallization or at the contact-SiC interface, and the contact showed no appreciable thickness increase as a result of the annealing process. The results demonstrate that aside from maintaining the desirable electrical integrity associated with Ni and Ni/Si Ohmic contacts, the Ni<sub>2</sub>Si Ohmic contacts possessed improved interfacial, compositional, microstructural, and surface properties which are required for reliable high temperature and high power device operation.

DTIC

*Electrochemistry; Electrical Properties; Electric Contacts*

**20020040336** Army Cold Regions Research and Engineering Lab., Hanover, NH USA

**Analysis of Nitroglycerine in Soils and on Mortar Fins Using GC-TID**

Hewitt, Alan D.; Feb. 2002; 25p; In English

Report No.(s): AD-A399520; ERDC/CRREL-TR-02-3; SFIM-AEC-PC-CR-200202; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A method of analysis for nitroglycerine (NG) in soil and on the surfaces of mortar fins (a common range scrap material) was developed using a field-portable gas chromatograph system. The method combines quick and simple sample preparation procedures with a rapid gas chromatographic (GC) analysis using a thermionic ionization detector (TID) that is selective for compounds containing nitro (NO<sub>2</sub>) functional groups. Very good agreement was observed among NG values established for splits of sample extracts by GC-TID and two accepted methods of analysis (high-performance liquid chromatography and GC electron capture). The method detection limit (MDL) for NG in soil established by GC-TID analysis was 0.1 mg/kg.

DTIC

*Gas Chromatography; Soils; Nitroglycerin; Metal Particles; Thermionics*

**20020040376** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Rocket Plume Tomography of Combustion Species**

Kutrieb, Joshua M.; Dec. 2001; 93p; In English

Report No.(s): AD-A399398; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Interest in accurate detection and targeting of aggressor missiles has received considerable interest with the national priority of developing a missile defense system. Understanding the thermal signatures of the exhaust plumes of such missiles is key to accomplishing that mission. Before signature models can be precisely developed for specific rockets, the radiation of the molecular or combustion species within those plumes must be accurately predicted. A combination translation/rotation scanning diagnostic technique has been developed to map the combustion species of a rocket plume and characterize its radiation properties. Using new infrared spectrometer and fiber optic cable technology to transmit the signal spectrum of interest, the custom designed mechanism can sweep through two dimensions of a steady-state rocket exhaust. A glow bar, or blackbody simulator, is shuttered on the opposite side of the plume, allowing the spectrometer to measure both the emission and absorption spectra. This thesis demonstrated the first time use of fiber optic cable to transmit infrared emission/absorption (E/A) spectra from a rocket plume to an infrared detector. This new fiber optic configuration allows for rapid translation and rotation around the rocket plume, establishing the capability for rapid spatial characterization of the combustion species present. Experimental results may then be compared to DoD rocket plume model predictions to highlight areas for improvement.

DTIC

*Combustion; Fiber Optics; Transmission Lines; Tomography; Rocket Exhaust*

**20020040801** Army Construction Engineering Research Lab., Champaign, IL USA

**Pyrolytic Decomposition Studies of AA2, A Double-Base Propellant Final Report**

Cropek, Donald M.; Kemme, Patricia A.; Day, Jean M.; Oct. 2001; 44p; In English

Report No.(s): AD-A399586; ERDC/CERL-TR-01-66; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pyrolysis is the thermal decomposition of a substance into a variety of by-products, usually in the absence of oxygen. Pyrolysis experiments comparing the behavior of AA2 with the behavior of individual constituents of AA2 provide an excellent example of the additive property that sometimes exists during thermal degradation of composites. The origin of each pyrolytic by-product from AA2 can be deduced by examining set of pyrolysis products from each constituent. Good matching between pyrolytic and incineration data can support using laboratory pyrolysis to predict incineration behavior. Samples of original AA2 from an Army installation were collected for analysis. In addition, chemical standards were obtained for the major components

of AA2. All samples and standards were subjected to pyrolysis and the by-products were analyzed by gas chromatography/mass spectrometry.

DTIC

*Double Base Propellants; Pyrolysis; Thermal Decomposition*

**20020040840** NASA Ames Research Center, Moffett Field, CA USA

**Displacement Energies for Nanorods**

Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; [1996]; 1p; In English

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

The geometries have been optimized and harmonic frequencies computed for three small hydrocarbon rods. The two lowest unique frequencies correspond to a torsion and a bend of the rods. The energy to bend or twist the rods has been computed by adding a fraction of the normal coordinate corresponding to these two modes to the equilibrium geometry. The density functional theory (using B3LYP) and self-consistent field (SCF) results are very similar for all properties considered.

Author

*Hydrocarbons; Rods; Resonant Frequencies; Nanostructure (Characteristics)*

**20020040841** NASA Ames Research Center, Moffett Field, CA USA

**The Successive OH Binding Energies of  $\text{Sc}(\text{OH})_n^+$  for  $n=1-3$**

Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; Partridge, Harry, NASA Ames Research Center, USA; [1996]; 1p; In English

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

The geometries of  $\text{Sc}(\text{OH})_n^+$ , for  $n = 1-3$ , have been optimized using density functional theory, in conjunction with the B3LYP hybrid functional. The zero-point energies are computed at the same level of theory. The successive OH bond energies have been computed at the CCSD(T) level for  $\text{ScOH}^+$  and  $\text{Sc}(\text{OH})_2^+$ . The computed result for  $\text{ScOH}^+$  is in excellent agreement with the recent experiment of Armentrout and co-workers. There is a dramatic drop for the third OH, because  $\text{Sc}^+$  has only two valence electrons and therefore the bonding changes when the third OH is added. The difference between the B3LYP and CCSD(T) OH binding energies for the first two OH groups is discussed.

Author

*Hydroxides; Scandium Compounds; Binding Energy; Molecular Structure*

**20020040852** Brookhaven National Lab., Upton, NY USA

**Generation, transport and deposition of tungsten-oxide aerosols at 1000 c in flowing air-steam mixtures**

Greene, G. A.; Finfrock, C. C.; Oct. 01, 2001; 50p; In English

Report No.(s): DE2002-789898; BNL--52645; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Experiments were conducted to measure the rates of oxidation and vaporization of pure tungsten rods in flowing air, steam and air-steam mixtures in laminar flow. Also measured were the downstream transport of tungsten-oxide condensation aerosols and their region of deposition, including plateout in the superheated flow tube, rainout in the condenser and ambient discharge which was collected on an array of sub-micron aerosol filters. The nominal conditions of the tests, with the exception of the first two tests, were tungsten temperatures of 1000 C, gas mixture temperatures of 200 C and wall temperatures of 150 C to 200 C. It was observed that the tungsten oxidation rates were greatest in all air and least in all steam, generally decreasing non-linearly with increasing steam mole fraction. The tungsten oxidation rates in all air were more than five times greater than the tungsten oxidation rates in all steam. The tungsten vaporization rate was zero in all air and increased with increasing steam mole fraction. The vaporization rate became maximum at a steam mole fraction of 0.85 and decreased thereafter as the steam mole fraction was increased to unity. The tungsten-oxide was transported downstream as condensation aerosols, initially flowing upwards from the tungsten rod through an 18-inch long, one-inch diameter quartz tube, around a 3.5-inch radius, 90(sup 0) bend and laterally through a 24-inch horizontal run. The entire length of the quartz glass flow path was heated by electrical resistance clamshell heaters whose temperatures were individually controlled and measured. The tungsten-oxide plateout in the quartz tube was collected, nearly all of which was deposited at the end of the heated zone near the entrance to the condenser which was cold. The tungsten-oxide which rained out in the condenser as the steam condensed was collected with the condensate and weighed after being dried. The aerosol smoke which escaped the condenser was collected on the sub-micron filter assemblies. There was no aerosol generation for the case of all air, so the plateout, condensate and smoke were all zero. For the case of all steam, there was very little plateout in the superheated regions (several percent) and the rest of the aerosol was collected in the condensate from the condenser. There was no smoke discharge into the filters. For the experiments with intermediate air-steam fractions, there was

some aerosol plateout, considerable aerosol in the condensate and aerosol smoke discharged from the condenser with the escaping air.

NTIS

*Aerosols; Deposition; Oxidation; Tungsten Oxides; Steam; Gas Mixtures*

## 26

### METALS AND METALLIC MATERIALS

*Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.*

**20020039913** Ufa State Technical Aviation Univ., Inst. of Physics of Advanced Materials, Russia

**Nanostructures and Enhanced Properties in Tungsten and its Alloys Processed by Equal Channel Angular Pressing**  
**Interim Report, 11 Oct. 2001-10 Jan. 2002**

Valiev, R. Z.; Alexandrov, I. V.; Jan. 10, 2002; 5p; In English

Contract(s)/Grant(s): N68171-01-M-5641

Report No.(s): AD-A399187; R/D-9135-MS-01; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this connection, in the frame of the third period of the present project there have been conducted experimental investigations, aimed at equal channel angular pressing (ECAP) optimization of the investigated W and the 90W-8Ni-2Fe alloy. The problem of this task consists in enhancing workability of these hard-to-deform materials and achieving large strains. The influence of the accumulated strain degree the thickness of protection casing, the rate and strain temperatures on grain size and homogeneity of the obtained structure have been investigated as parameters, determining ECAP results. ECAP has been realized on route C, which turns out to be the most effective route for the given case, as it has been found out at first stages of the project.

DTIC

*Finite Element Method; Alloys; Tungsten; Grain Size; Pressing (Forming); Stress-Strain Relationships*

## 27

### NONMETALLIC MATERIALS

*Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.*

**20020039170** NASA Glenn Research Center, Cleveland, OH USA

**MISSE PEACE Polymers: An International Space Station Environmental Exposure Experiment**

deGroh, Kim K., NASA Glenn Research Center, USA; Banks, Bruce A., NASA Glenn Research Center, USA; Hammerstrom, Anne M., Hathaway Brown School, USA; Youngstrom, Erica E., Hathaway Brown School, USA; Kaminski, Carolyn, Hathaway Brown School, USA; Marx, Laura M., Hathaway Brown School, USA; Fine, Elisabeth S., Hathaway Brown School, USA; Gummow, Jonathan D., Ohio Aerospace Inst., USA; Wright, Douglas, Cleveland State Univ., USA; November 2001; 16p; In English; International Space Station Utilization-2001, 15-18 Oct. 2001, Cape Canaveral, FL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 755-1A-13

Report No.(s): NASA/TM-2001-211311; E-13113; NAS 1.15:211311; AIAA Paper 2001-4923; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Forty-one different polymers are being exposed to the low Earth orbit (LEO) environment on the exterior of the International Space Station (ISS) for one year as part of MISSE (Materials International Space Station Experiment). MISSE is a materials flight experiment sponsored by the Air Force Research Lab/Materials Lab and the National Aeronautics and Space Administration (NASA). A second set of the same polymers is planned to be flown as part of PEACE (Polymer Erosion and Contamination Experiment), a short duration shuttle flight experiment, and therefore these 41 polymers on ISS are collectively called the MISSE PEACE Polymers. The objective of the MISSE PEACE Polymers experiment is to accurately determine the atomic oxygen (AO) erosion yield of a wide variety of polymeric materials. The polymers range from those commonly used for spacecraft applications, such as Teflon<sup>®</sup>/FEP, to more recently developed polymers, such as high temperature polyimide PMR (polymerization of monomer reactants). Additional polymers were included to explore erosion yield dependence upon chemical composition. Details on the specific polymers being flown, flight sample fabrication, and pre-flight characterization techniques will be discussed. The MISSE PEACE Polymers experiment was placed on the exterior of ISS during a spacewalk on August 16, 2001 and is planned to be retrieved in the fall of 2002. The erosion yield data obtained from this experiment will be compared with data from the future short

duration experiment PEACE and with predicted results from models developed by a Canadian group that predicts the AO erosion yield of organic materials based on their chemical structure. Having flight data, and comparing flight data with the predictive model results, will be valuable for spacecraft design purposes.

Author

*Earth Orbital Environments; Erosion; Organic Materials; Oxygen Atoms; Polyimides; Spacecraft Construction Materials; Spaceborne Experiments*

**20020039171** Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan

**Measurements of the Thermal Conductivity and Thermal Diffusivity of Polymer Melts with the Short-Hot-Wire Method**

Wicaksono, Hendro, Kyushu Univ., Japan; Zhang, Xing, Kyushu Univ., Japan; Fujii, Motoo, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 2001; ISSN 0914-3793; Volume 15, No. 2, pp. 159-163; In English Contract(s)/Grant(s): MOE-11750167; Copyright; Avail: Issuing Activity

In this paper, the thermal conductivity and thermal diffusivity of four kinds of polymer melts were measured by using the transient short-hot-wire method. This method was developed from the hot-wire technique and is based on two-dimensional numerical solutions of unsteady heat conduction from a wire with the same length-to-diameter ratio and boundary conditions as those in the actual experiments. The present method is particularly suitable for measurements of molten polymers where natural convection effects can be ignored due to their high viscosities. The results have shown that the present method can be used to measure the thermal conductivity and thermal diffusivity of molten polymers within uncertainties of 3 and 6%, respectively. Further, the thermal conductivity and thermal diffusivity of solidified samples were also measured and discussed.

Author

*Conductive Heat Transfer; Numerical Analysis; Thermal Conductivity; Thermal Diffusivity; Melts (Crystal Growth)*

**20020039315** Department of the Navy, Washington, DC USA

**Acoustically Enhanced Paint Application**

Ruffa, Anthony A., Inventor; Jul. 30, 2001; 15p; In English

Patent Info.: Filed 30 Jul. 2001; US-Patent-Appl-SN-09917591

Report No.(s): AD-D019996; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The present invention is a method of coating a substrate. First, a layer of liquid polymeric coating having a pigment and a solvent is applied to the substrate. An ultrasonic acoustic source is then provided and operated at a frequency of from about above 40 kHz to provide an acoustic pressure field and an acoustic pressure of above 190 dB and directing the main lobe of the acoustic pressure field toward the layer of liquid polymeric coating. This acoustic pressure field reduces the gradient in and smoothes any uneven surface features in the liquid polymeric coating.

DTIC

*Patent Applications; Paints; Sound Fields; Polymeric Films; Plastic Coatings*

**20020039735** Thermoscience Inst., Moffett Field, CA USA

**Thermal Response and Ablation Programs for TPS Sizing Computation**

Chen, Y. K., Thermoscience Inst., USA; [1997]; 1p; In English; Workshop on Aeroassist Technologies, 14-16 Jan. 1997, Pasadena, CA, USA

Contract(s)/Grant(s): NAS2-14031; RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

The computer programs developed at NASA Ames Research Center for TPS sizing computation have been applied to many NASA's space missions, such as Mars Pathfinder, StarDust, Mars 2001, DS-II, and Saturn Entry Probe. These computer programs include FIAT (Fully Implicit Ablation and Thermal Response Program, MAT (Multi-component Ablation Thermochemistry Program), TPSX (Thermal Protection Systems Expert & Material Properties Database), and TPSGui (Thermal Protection Systems Graphical User Interface). For most planetary missions, the aerothermodynamics and material response are strongly coupled; thus a closed loop iteration technique between the FIAT and CFD (Computational Fluid Dynamics) codes has been developed to obtain the high fidelity bench mark TPS sizing solution. The computer codes and predictive methods are presented and discussed in detail.

Author

*Thermal Protection; Ablation; Computer Programs; Computational Fluid Dynamics; Feedback Control; Prediction Analysis Techniques*

**20020039862** NASA Ames Research Center, Moffett Field, CA USA

**TPS Materials for Planetary Exploration**

Rasky, Daniel J., NASA Ames Research Center, USA; [1997]; 1p; In English; Workshop on Aeroassist Technologies, 14-16 Jan. 1997, Pasadena, CA, USA

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

This paper will review the current material options, and near term developments, for thermal protection systems (TPS) of future space craft involving atmospheric entry. TPS is a very important element in the design of these vehicles, and can have large impact on the project risk and cost. The new family of light weight ceramic ablators illustrated by SIRCA and PIC will be discussed, along with state-of-the-art ablators including SLA-561V, Avcoat-5026, carbon-phenolic, and carbon-carbon.

Author

*Ablative Materials; Carbon-Phenolic Composites; Ceramics; Thermal Protection*

**20020039950** Thermoscience Inst., Moffett Field, CA USA

**Stress Calculations for Carbon Nanotubes**

Halicioglu, Timur, Thermoscience Inst., USA; [1996]; 1p; In English

Contract(s)/Grant(s): NAS2-14031; No Copyright; Avail: Issuing Activity; Abstract Only

Atomic stresses were calculated for carbon nanotubes under strain conditions. Graphitic tubules with radii ranging from approximately 2 to 11 Angstroms and two different tubule structures with varying atomic orientations were included in the calculations. Elongations and contractions were applied in the axial direction and atomic stress values were calculated for infinitely long tubules. The calculations were carried out using Brenner's function which was developed for carbon species. Results indicate that the stress is tensile in the radial direction while it is compressive in the tangential direction. Variations in stress values in the direction of the cylindrical aids were investigated as a function of applied strain. Furthermore, using the stress-strain curve (calculated based on atomic considerations), the values of Young's modulus and Poisson's ratio for nanotubes were also estimated.

Author

*Carbon Nanotubes; Stress Analysis; Mechanical Properties; Structural Strain*

**20020039971** Thermoscience Inst., Moffett Field, CA USA

**Permeability of Rigid Fibrous Refractory Insulations**

Marschall, J.; Milos, F. S.; [1996]; 1p; In English; AIAA 32nd Thermophysics Conference, 23-25 Jun. 1997, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS2-14031; RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

Rigid fibrous refractory insulations (TPS tiles) are integral components of many spacecraft thermal protection systems. These materials are composed of refractory fibers With diameters on the order of 1 to 15 micrometers. They are lightweight and have an open, highly porous microstructure. Typical densities are less than 500 kilograms per cubic meters, and porosities generally exceed 0.8. Because of their open porosity, these materials are permeable to gas flow. There are numerous instances in which internal gas transport in a thermal protection system could be important; examples include the penetration of hot boundary-layer gases into the insulation, the flow of decomposition (pyrolysis) products from the interior, the use of convective flows to mitigate ice formation caused by cryopumping, and the design of refractory vents for pressure equilibration during atmospheric entry. Computational analysis of gas flow through porous media requires values of permeability which have not previously been available for the rigid fibrous insulations used in thermal protection systems. This paper will document measurements of permeability for a variety of insulations from NASA's LI, FRCI, and AETB families of lightweight ceramic ablators. The directional anisotropy of permeability and its dependence on gas pressure and material density will be presented. It will be shown that rarified-flow effects are significant in the flow through such materials. Connections will be drawn between the insulation microstructure and permeability. The paper will also include representative computations of flow through rigid fibrous insulations.

Author

*Insulation; Permeability; Thermal Protection; Rigid Structures; Fibers*

**20020040396** Mississippi Polymer Technologies, Inc., Bay Saint Louis, MS USA

**High Performance Polyphenylene Resins Final Report, 24 Jul. 2000-29 Dec. 2001**

Gagne, Robert; Malkovich, Nick; Dec. 2001; 33p; In English

Contract(s)/Grant(s): DAAD17-00-C-0125

Report No.(s): AD-A399445; Rept-563; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary technical objectives of this ARL contract effort were to further develop Parmax(R) resins offering unprecedented mechanical properties that would enable the future production of a variety of lightweight advanced defense components. Given the unique chemical structure, morphology and molecular dynamics of these materials, a better understanding of the processes controlling and affecting the performance and processing of Parmax(R) polyphenylene resins is needed. To achieve this understanding and develop material properties control, a multi-pronged research effort was initiated.

DTIC

*Polyphenyls; Resins*

**20020040874** Aerospace Corp., Technology Operations, El Segundo, CA USA

**Stress Measurements in Silicon Microstructures**

Amimoto, S. T.; Chang, D. J.; Birkitt, A. D.; Jan. 2002; 18p; In English; Original contains color images

Contract(s)/Grant(s): F04701-93-C-0094

Report No(s): AD-A399599; TR-2000(8565)-11; SMC-TR-02-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Raman spectroscopy is used as a noncontact probe of stress with high spatial resolution in micromachined silicon structures. The motivation for this work is that reliability or cycle life can be substantially increased by understanding the distribution of stress, including residual stress. High stresses induced by workmanship shortcomings or design constraints may be addressed by Raman measurements. In microelectronics, stress is known to play a significant role in interconnects, which limits reliability, life, and ultimately cost of many circuits. We wish to demonstrate the utility of Raman spectroscopy as a tool for the development and design of silicon microstructures. The equations for a general two-dimensional stress field are discussed. Calibration studies using macromechanical fixtures for single crystal silicon specimens under two-dimensional stress field are presented. Our measurements show good agreement with the theoretical values and thus validate the approach taken. Stress maps of conventionally fabricated test structures, laser-machined structures, and polysilicon structures are presented.

DTIC

*Raman Spectroscopy; Stress Distribution; Microstructure; Silicon; Microelectronics; Stress Measurement*

**20020040895** NASA Ames Research Center, Moffett Field, CA USA

**PICA Forebody Heatshield Qualification for the Stardust Discovery Class Mission**

Tran, Huy K., NASA Ames Research Center, USA; Johnson, Christine E., NASA Ames Research Center, USA; Hsu, Ming-Ta, Chem (H. C.) Co., USA; Smith, Marnell, Chem (H. C.) Co., USA; Dill, Harry, Orbital Sciences Corp., USA; [1996]; 1p; In English; 32nd AIAA Thermophysics Conference, 23-25 Jun. 1997, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

This paper presents the qualification of the light weight Phenolic Impregnated Carbon Ablators (PICA) as the forebody heatshield for the Stardust Discovery Class Mission. The Stardust spacecraft will be launched in early 1999 and fly by Comet Wild-2 to collect cometary and interstellar dust and return them back to earth in the Sample Return Capsule (SRC). This earth re-entry will be the fastest to date, at 12.6 km/s, and therefore requires a heatshield that can withstand very high heating rates and stagnation pressures, as well as provide the necessary insulation to the vehicle structure. The PICA material was developed as part of the Lightweight Ceramic Ablators program at NASA Ames Research Center, and was baselined as the forebody heatshield because of its low density and superior ablation and thermal performance at severe aerothermodynamic conditions. Under a Small Business Innovative Research (SBIR) program with NASA Ames, Fiber Materials, Inc. developed a process to manufacture a single-piece PICA heatshield for the forebody of the SRC, along with witness material for the fabrication of the test models. The test models were fabricated and instrumented by the staff of Lockheed Martin Astronautics in Denver, Colorado. Full body preliminary aerothermal CFD calculations were performed at NASA Ames to determine the heating and stagnation pressure conditions. The Heat shield sizing was also performed at NASA Ames by using a new material response code that accounts for the highly porous characteristics of the PICA material. The ablation and thermal performance of PICA was qualified in the NASA Ames Interaction Heating Arc Jet Facility. A total of 24 models and four test conditions were used to qualify PICA at the predicted peak heat flux, heat load, shear, and stagnation pressure conditions. Surface and in-depth temperatures were measured using optical pyrometers and thermocouples. Surface recession was measured by using a template and a height gage. Several models were tested to evaluate repair procedures, and two models were cold soaked in liquid nitrogen, prior to testing, to investigate the effect of the cold space environment on the performance of the material. In addition, material cored from a demonstration

single-piece heatshield was tested to verify that the PICA process can be successfully completed on a large, complex heatshield shape.

Author

*Heat Shielding; Stardust Mission; Carbon-Phenolic Composites; Ablative Materials; Aerothermodynamics*

## 28

### PROPELLANTS AND FUELS

*Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.*

**20020039744** Johns Hopkins Univ., Chemical Propulsion Information Agency, Silver Spring, MD USA

#### **JANNAF Solid Propellant Structural Integrity Handbook**

Browning, S. C., Hercules, Inc., USA; Hufferd, William L., Editor, Utah Univ., USA; Fitzgerald, J. Edmund, Editor, Utah Univ., USA; Anderson, G. P., Thiokol Chemical Corp., USA; Anderson, J. M., Hercules, Inc., USA; Deverall, L. I., United Technology Center, USA; Farris, R. J., Utah Univ., USA; Jones, W. B., North American Rockwell Corp., USA; Knauss, W. G., California Inst. of Tech., USA; Leeming, H., Lockheed Propulsion Co., USA; September 1972; 578p; In English

Contract(s)/Grant(s): N00017-72-C-4401

Report No.(s): CPIA-Publ-230; UTEC-CE-72-160; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The objective of the JANNAF (Joint Army, Navy, NASA, and Air Force) Solid Propellant Grain Structural Integrity Handbook is to provide, in revisable and expandable form, the most currently acceptable methods for predicting the structural integrity of solid propellant rocket motor grains. The methods presented are not always satisfactory for the solution of grain structural analysis problems, but they are considered by the Structural Integrity Committee to represent the published state-of-the-art at the present time. The Handbook is oriented mainly toward the solid rocket grain structural designer/analyst whose responsibility primarily involves application of analysis methods in contrast to development of analysis methods. Derivations of formulas and detailed explanations are therefore omitted. Examples are included, however, as well as numerous references to literature giving more background and details of the methods presented.

Derived from text

*Propellant Grains; Structural Analysis; Solid Rocket Propellants*

**20020040773** National Renewable Energy Lab., Golden, CO USA

#### **EPAct Fleet Information and Regulations: State and Alternative Fuel Provider Program, Annual Report FY 2001**

White, H.; Melendez, M.; Dec. 06, 2001; 4p; In English

Report No.(s): DE2002-789769; DOE/GO-102001-1484; NREL/MP-540-31249; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A detailed account of the activity and accomplishments made by fleets covered by the EPAct State and Alternative Fuel Provider Program.

NTIS

*Synthetic Fuels; Environment Protection; Regulations*

**20020040778** National Renewable Energy Lab., Golden, CO USA

#### **Denver SuperShuttle CNG Fleet Evaluation *Evaluacion de la flotilla de GNC de la empresa SuperShuttle de Denver***

LaRocque, T.; Oct. 01, 2001; 8p; In English

Report No.(s): DE2002-789076; NREL/FS-540-30144; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A description of a joint effort between Denver SuperShuttle, the Gas Research Institute (GRI) and DOE that evaluated two types of bi-fuel and compressed natural gas.

NTIS

*Evaluation; Natural Gas; Compressed Gas*

**20020040779** National Renewable Energy Lab., Golden, CO USA

**Partnership to Advance Alternative Fuel Vehicles** *Ciudades Limpias: Alianza Para Promover El Uso De Vehiculos De Combustibles Alternativos*

LaRocque, T.; Oct. 01, 2001; 5p; In English

Report No.(s): DE2002-789077; NREL/FS-540-30201; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This fact sheet provides a question and answer overview of the Clean Cities program including what it is, how it works, the program's accomplishments, and a map of Clean Cities throughout the USA.

NTIS

*Synthetic Fuels; Combustion; Automobiles*

**20020040838** Department of Energy, Washington, DC USA

**Coal Power Systems strategic multi-year program plans**

Feb. 01, 2001; 151p

Report No.(s): DE2002-770944; DOE/FE-0432; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Department of Energy's (DOE) Office of Fossil Energy (FE), through the Coal and Power Systems (C and PS) program, funds research to advance the scientific knowledge needed to provide new and improved energy technologies; to eliminate any detrimental environmental effects of energy production and use; and to maintain US leadership in promoting the effective use of US power technologies on an international scale. Further, the C and PS program facilitates the effective deployment of these technologies to maximize their benefits to the Nation. The following Strategic Plan describes how the C and PS program intends to meet the challenges of the National Energy Strategy to: (1) enhance American's energy security; (2) improve the environmental acceptability of energy production and use; (3) increase the competitiveness and reliability of US energy systems; and (4) ensure a robust US energy future. It is a plan based on the consensus of experts and managers from FE's program offices and the National Energy Technology Laboratory (NETL).

NTIS

*Coal; Energy Technology*

**20020040854** National Renewable Energy Lab., Golden, CO USA

**Technoeconomic Analysis of the Thermocatalytic Decomposition of Natural Gas**

Lane, J.; Spath, P.; Dec. 04, 2001; 39p; In English

Report No.(s): DE2002-789770; NREL/TP-510-31351; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

NREL conducted economic analysis examining two process designs for producing hydrogen from thermocatalytic decomposition based on research by Dr. Nazim Muradov of FSEC.

NTIS

*Natural Gas; Catalytic Activity; Economic Analysis; Technology Assessment; Thermal Decomposition*

## 29

### SPACE PROCESSING

*Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see 84 Law, Political Science and Space Policy.*

**20020039842** Lockheed Martin Engineering and Sciences Co., Moffett Field, CA USA

**Capillary Movement in Granular Beds in Microgravity**

Yendler, Boris S., Lockheed Martin Engineering and Sciences Co., USA; Bula, Ray J., Wisconsin Univ., USA; [1996]; 1p; In English

Contract(s)/Grant(s): RTOP 199-61-62; No Copyright; Avail: Issuing Activity; Abstract Only

Understanding the dynamics of capillary flow through unsaturated porous media is very important for the development of an effective water and nutrient delivery system for growing plants in microgravity and chemical engineering applications. Experiments were conducted on the Space Shuttle during the STS-63 mission using three experimental cuvettes called "Capillary Testbed-M." These experiments studied the effect of bead diameter on capillary flow by comparing the capillary flow in three different granular beds. It was observed that the speed of water propagation in the granular bed consisting of 1.5 mm diameter

particles was less than that in the bed consisting of 1.0 mm. diameter particles. Such results contradict the existing theory of capillary water propagation in granular beds. It was found also that in microgravity water propagates independently in adjacent layers of a layered granular bed .

Author

*Microgravity Applications; Capillary Flow; Granular Materials; Microgravity*

## 31

### ENGINEERING (GENERAL)

*Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see categories 32 through 39.*

**20020039305** Teledyne Brown Engineering, Huntsville, AL USA

#### **Measuring Background Convectivity**

Cox, Randy; Fuentes, Roland; Dec. 1998; 9p; In English; Original contains color images

Report No.(s): AD-A399454; No Copyright; Avail: Defense Technical Information Center (DTIC)

We have developed an instrument to measure the relative or absolute values of convection in some environment. The device eliminates or reduces the radiation and conduction effects between the itself and its environment so that essentially all of the heat lost by the it is lost by convection. When correlated with environmental data collected simultaneously with the measurements of the device performance, a coefficient of convection may be computed and displayed in real time. This coefficient is important in the understanding of natural heat transfer process in the environment, and how man-made objects subjected to that environment by react. In particular, we use the meter to help us determine the contribution of convection to the overall thermal balance of camouflage designed for military use. Herein, we describe in detail the device, its operating principles, and how the data it yields is used for better understanding of thermal signatures and the design of thermal camouflage.

DTIC

*Measuring Instruments; Convection*

**20020040401** Army Engineer Research and Development Center, Coastal and Hydraulics Lab., Vicksburg, MS USA

#### **Development of a Large-Scale Laboratory Facility for Sediment Transport Research *Final Report***

Hamilton, David G.; Ebersole, Bruce A.; Smith, Ernest R.; Wang, Ping; Sep. 2001; 187p; In English; Original contains color images

Report No.(s): AD-A399451; ERDC/CHL-TR-01-22; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report documents the development and initial applications of the Large-scale Sediment Transport Facility (LSTF), which is located at the U.S. Army Engineer Research and Development Center (ERDC), Coastal and Hydraulics Laboratory (CHL), Vicksburg, MS. The LSTF was built to facilitate basic and applied research in the field of coastal sediment transport processes. Work reported here was fluided by Work Unit 32870 "Large-Scale Laboratory Investigation of Longshore Sediment Transport," which is under the Coastal Sedimentation and Dredging Program, General Investigations Research and Development Program, U.S. Army Corps of Engineers. A large-scale facility for investigating nearshore and surf zone sediment transport processes has been constructed and successfully applied. This facility provides the Corps of Engineers with a capability for studying longshore sand transport at scales that are much larger than the scales at which previous laboratory research has been conducted to examine these processes. The LSTF is state-of-the-art in terms of the systems that have been built for generating relatively large-scale laboratory waves, pumping and recirculating the longshore current, measuring the quantity of sand that moves along the beach, and a fully programmable instrumentation bridge and data acquisition system that includes 10 ADV current sensors, 10 capacitance-type wave gauges, four FOBS arrays, and an automated beach profiling system. All facility components were designed to maximize accuracy of data acquired in movable-bed experiments and minimize the amount of human labor (and time) required to perform them. The LSTF has proven to be an excellent and robust facility and, so far, has yielded unprecedented measurements of surf zone sediment transport processes in a laboratory setting, including sand transported in suspension. The potential for making R&D advancements through the use of the facility is quite high.

DTIC

*Sediment Transport; Research Facilities; Water Currents*

## 32 COMMUNICATIONS AND RADAR

*Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 Space Communications, Spacecraft Communications, Command and Tracking; for search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation and Safety.*

**20020039138** Lembaga Penerbangan dan Antariksa Nasional, Puslitbang Pengetahuan Ionosfer, Jakarta, Indonesia

**Critical Frequency Pattern and E Sporadic Layer Height Over Biak During Meteor Showers** *Pola Frekuensi Kritis Dan Ketinggian Lapisan E Sporadis Di Atas Biak Pada Saat Terjadi Hujan Meteor*

Rusnadi, Iyus Edi, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Ristanti, Nancy, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Djamaluddin, Thomas, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; October 2000; ISSN 0126-0480; Volume 2, No. 4, pp. 159-166; In Malay-Indonesian; Copyright; Avail: Issuing Activity

Change of critical frequency and height of E sporadic formed certain patterns. Solar activity, geomagnetic activity, and meteor showers influence this change. In order to get the pattern of critical frequency and height of E sporadic formed by meteoroid cluster the effect from solar and geomagnetic activity should be eliminated.

Author

*Critical Frequencies; Patterns; E Region; Sporadic Meteoroids*

**20020039150** Lembaga Penerbangan dan Antariksa Nasional, Peneliti di Bidang Komunikasi HF Puslitbang PI, Jakarta, Indonesia

**Prediction of HF Radio Frequency Based on Solar Activities** *Model Prediksi Frekuensi Komunikasi Radio HF Dengan Basis Aktivitas Matahari*

Habirun, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; October 2000; ISSN 0126-0480; Volume 2, No. 4, pp. 186-194; In Malay-Indonesian; Copyright; Avail: Issuing Activity

The prediction of the HF radio communication frequency based on solar activities affects the foF2 critical frequency and h'F2 scale height ionospheric layer characteristics, that is based on linear relation between ionospheric layer critical frequency with sunspot numbers as solar activities indicator. For sunspot numbers prediction be used Auto Regression Moving Average-ARMA(2,1) two and one order model. The sunspot numbers prediction result be used as input linear model mentioned above so that the foF2 and h'F2 prediction could be obtained. Furthermore the foF2 and h'F2 prediction results be used to estimate the HF radio communication frequency between Ambon-Manado and Ambon-Jayapura by using the secant method for then calculation. The results showed that the reliability of the sunspot numbers model on solar activities R impact = 100 and R = 0 gave contribution to the f6F2 empiric model (July model performance) which was showed from the same pattern correlation and standard deviation of 0.99 and 1,0 MHz. Such was the h'F2 empiric model. Showed the pattern correlation 0,90 and 0,97 with standard deviation 20,12 km and 20,11 km on the same solar activities impact.

Author

*Radio Frequencies; High Frequencies; Solar Activity; Reliability*

**20020039155** Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Komunikasi HF Puslitbang PI, Jakarta, Indonesia

**Method Determination in Ionosphere T Index Calculation on the Manado-Bandung Communication Circuit** *Penentuan Metode Untuk Menghitung Indeks T Ionosfer Pada Sirkuit Komunikasi Antara Manado-Bandung*

Habirun, Jiyo, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Sjarifudin, M., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Cucu, E. H., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; October 2000; ISSN 0126-0480; Volume 2, No. 4, pp. 151-158; In Malay-Indonesian; Copyright; Avail: Issuing Activity

The prediction of the HF (High Frequency) communication frequency by using ASAPS (Advanced Stand Alone Prediction System) prediction method with global T index as an input is not suitable for local ionospheric condition of Indonesian region. So that this research objective is to develop a method for local T index calculation. The local T index which was calculated on this method based on T index as a function of MUF (Maximum Usable Frequency). The MUF was known from the Manado-Sumedang ionogram oblique soundings, so the local T index can be calculated for the Manado-Bandung communication circuit. Furthermore the calculation result was used as input for the ASAPS prediction method to predict HF radio communication frequency which is suitable to predict local ionospheric condition. The prediction method/model linear mentioned above the output equation from  $T(\text{sub } kij) = a(\text{sub } ki) + b(\text{sub } ki)MUF(\text{sub } kij)$ , with a and b certain for and by i classes on k hour, on k hour

be sampled  $i$  classes and on certain classes to pound  $j$  data. The validation result based on model error from all classes showed 0,66 MHz with 0,9913 pattern correlation coefficient and difference between model output and observation data was 3%.

Author

*Ionospheric; High Frequencies; Prediction Analysis Techniques; Temperature Distribution*

**20020039160** New Mexico State Univ., Klipsch School of Electrical and Computer Engineering, Las Cruces, NM USA

**Center for Space Telemetry and Telecommunications Systems, New Mexico State University Annual Report**

Horan, Stephen, New Mexico State Univ., USA; DeLeon, Phillip, New Mexico State Univ., USA; Borah, Deva, New Mexico State Univ., USA; Lyman, Ray, New Mexico State Univ., USA; Mar. 18, 2002; 102p; In English

Contract(s)/Grant(s): NAG5-9323

Report No.(s): NMSU-ECE-02-001; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This viewgraph presentation gives an overview of the Center for Space Telemetry and Telecommunications Systems activities at New Mexico State University. Presentations cover the following topics: (1) small satellite communications, including nanosatellite radio and virtual satellite development; (2) modulation and detection studies, including details on smooth phase interpolated keying (SPIK) spectra and highlights of an adaptive turbo multiuser detector; (3) decoupled approaches to nonlinear ISI compensation; (4) space internet testing; (4) optical communication; (5) Linux-based receiver for lightweight optical communications without a laser in space, including software design, performance analysis, and the receiver algorithm; (6) carrier tracking hardware; and (7) subband transforms for adaptive direct sequence spread spectrum receivers.

CASI

*Nanosatellites; Optical Communication; Receivers; Satellite Communication; Telemetry; Telecommunication*

**20020039163** Lembaga Penerbangan dan Antariksa Nasional, Bidang Transmisi Komunikasi Dirgantara, Jakarta, Indonesia

**Design and Production of a Helix Antenna For Low Orbit Satellite Application Perancangan dan Pembuatan Antena Helix Untuk Aplikasi Satelit Orbit Rendah**

Ghozali, M., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; October 2000; ISSN 0126-0480; Volume 2, No. 4, pp. 165-171; In Malay-Indonesian; Copyright; Avail: Issuing Activity

The helix antenna is an antenna which fulfil requirement for the low orbit satellite, I.e the pattern radiation of the antenna should be uni directional and if frequencies of communication of satellite are less than 1 GHz the radiation should be circular polarized. This paper describes how to design and producing the helix antenna that fulfil the above requirement. Besides, the computation of maximum gain, input impedance and half beam width are also describe.

Author

*Design Analysis; Manufacturing; Satellite Antennas*

**20020039297** Lembaga Penerbangan dan Antariksa Nasional, Pusat Pemanfaatan Sains Antariksa, Jakarta, Indonesia

**Determination of HF Radio Communication Frequency Using the Maximum Likelihood Method on the Manado-Sumedang Communication Circuit Penentuan Frekuensi Komunikasi Radio HF Menggunakan Metode Kemungkinan Maksimum Pada Sirkuit Komunikasi Manado-Sumedang**

Habirun, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; March 2001; ISSN 0126-9754; Volume 3, No. 1, pp. 7-14; In Malay-Indonesian; Copyright; Avail: Issuing Activity

Determination of the HF (High Frequency) radio communication frequency on Manado-Sumedang communication circuit was done using Maximum Likelihood method based on conditional Gauss distribution and the result was compared with Manado-Sumedang oblique sounding. The oblique sounding is used as control point instrument of HF radio communication between Manado transmitter and Sumedang receiver. The Maximum Likelihood method was derived based on solar activities effect on ionospheric layer, because critical frequency ionospheric layer depending on solar activities and sunspot numbers  $R$  as indicator. So that its critical frequency ionospheric layer correlate linearly to sunspot numbers. Critical frequency of ionospheric layer calculated by the method and then HF radio communication frequency on ManadoSumedang communication circuit was determined by scant method. On the usage of HF radio communication frequency between Manado-Sumedang communication circuit during low solar activities, the accuracy was indicated by the standar deviation and pattern correlation to oblique MUF (Maximum Usable Frequency), i. e. respectively, 7,21 MHz and 0,689 for MUF calculated by the method and 7,47 MHz and 0,961 for MUF calculated from foF2 data.

Author

*Circuits; High Frequencies; Maximum Likelihood Estimates; Radio Communication; Solar Activity*

**20020039911** Woods Hole Oceanographic Inst., Dept. of Applied Ocean Physics and Engineering, MA USA

**Low Cost Modular Telemetry for Coastal Time-Series Data Final Report, Jul. 1999-30 Jun. 2001**

Frye, Daniel E.; Geyer, W. R.; Butman, Bradford; Feb. 11, 2002; 7p; In English; Original contains color images

Contract(s)/Grant(s): N00014-98-1-0816

Report No.(s): AD-A399201; WHOI-13081600; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The purpose of this project was to develop and demonstrate a low cost, easy to operate system for collecting and disseminating coastal ocean data. The system that was developed uses acoustic modems to transfer data from instruments on the seafloor to small surface buoys or existing navigation buoys that are equipped with acoustic receivers and RF (radio frequency) links. Data received by the buoy's acoustic receiver are forwarded via the RF link to a station on shore. The shore station transfers the received data via landline to WHOI (Woods Hole Oceanographic Institute) where it is automatically placed on a project website that is accessible to all. Key elements in this system include: 1) low cost acoustic transmitters that are deployed with each instrument, 2) small, easy to deploy surface buoys that carry the acoustic receivers and RF links, 3) a network architecture that allows a single surface buoy to receive data from a number of subsurface instruments, and 4) a back channel to the surface buoys from the laboratory at WHOI so that the acoustic receivers can be modified without requiring a visit to the site.

DTIC

*Telemetry; Oceanography; Time Series Analysis; Coasts*

**20020040095** Arcon Corp., Waltham, MA USA

**X-Band Radar Ground Clutter Statistics for Resolution Cells of Arbitrary Size and Shape**

Weijers, Bertus; Ernstmeyer, James; Poirier, Leon; Oct. 1999; 35p; In English

Contract(s)/Grant(s): AF Proj. 4600

Report No.(s): AD-A399215; AFRL-SN-HS-TR-2001-002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A procedure is developed for predicting the clutter reflectivity and probability density function of X-band radar clutter returns for resolution cells of arbitrary size and shape. The prediction uses high-resolution measurements of phase and amplitude of the ground reflections made by synthetic aperture radar (SAR) to estimate the properties of the clutter that would be observed with lower resolution radars. Clutter scene images collected by the MSTAR Program form the basis of this work. MSTAR public clutter scene data consists of spotlight mode X-band SAR images with typical resolution 0.3 x 0.3 m. Under certain assumptions, the statistics of the image pixels will approximate those of the associated clutter cells. The probability distribution of the complex pixel amplitudes is found to be significantly non-Gaussian. Larger resolution cells are constructed by coherently combining the returns from adjacent pixels. The statistical properties of clutter in these larger resolution cells is examined for a variety of cell sizes, shapes, and underlying terrain types.

DTIC

*Synthetic Aperture Radar; High Resolution; Radar Imagery; Clutter*

**20020040114** Center for Army Lessons Learned, Fort Leavenworth, KS USA

**Echoes of Chechnya Warfare Resound in Moscow, Quantico**

Ackerman, Robert K.; May 2000; 8p; In English

Report No.(s): AD-A399296; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Several months of Russian attacks have shifted the balance of power in Chechnya and changed U.S. thinking about urban warfare. After suffering stunning public defeats just a few years ago, Russian forces applied painful lessons learned then to drive Chechen forces out of their capital city, Grozny, this year. Yet, according to U.S. analysts, this may have merely altered the thrust of battle, not resolved it. And, the tactics employed by both sides are forcing U.S. experts to take another look at the concept of urban warfare. Where Russian forces entered Grozny in almost a parade-type atmosphere in the first Chechnya operation in 1994 to 1995, they began their most recent conflict last year by applying massive artillery strikes that changed the playing field by leveling parts of the city. They coordinated their brute-force strengths to define the combat on their terms as much as possible. The infrastructure of Grozny proved expendable in the drive to defeat rebel forces operating there. On the other hand, the Chechen rebels were quick to adapt to changing strategic, as well as tactical, situations. Recognizing the value of information operations, they employed advanced commercial communications systems that actually exceeded the quality of the military gear issued to the Russian army. Lacking Russia's vast manpower resources, Chechen forces withdrew from indefensible positions to rugged territory that more easily negates many of the Russian army's strengths.

DTIC

*Manpower; Artillery; Combat; Commerce; Warfare; Cities*

**20020040326** Defence Research Establishment Ottawa, Ottawa, Ontario Canada

**Reconfigurable Digital IIR and FIR Filters**

Gosselin, B.; Wilcox, C.; Nov. 2001; 109p; In English

Report No.(s): AD-A399503; DREO-TR-2001-099; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The work presented in this document contributes to the ROBR (Reconfigurable Omni Band Radio) project started by the Defence Research Establishment Ottawa and the Communication Research Centre in 1997. ROBR is a testbed implementation of a reconfigurable satellite communications (satcom) terminal that makes use of a software communications architecture. Such a system can enable the use of a single ground terminal to communicate over multiple satellite communications or terrestrial links by supporting multiple standards. The ROBR hardware architecture includes a microprocessor and several digital signal processor (DSP) boards. The objective of this report is to document the work done to provide a set of reconfigurable digital filters for use in the ROBR. Five infinite impulse response (IIR) filtering modules and four finite impulse response (FIR) filtering modules have been implemented. The function of these modules is to compute the coefficients of a desired filter design. Also, IIR and FIR signal processing modules have been implemented to process digital signals using the computed coefficients. The modules have been implemented in the C programming language and are targeted for use on a DSP chip. The implementation of the modules has been verified and compared with the results obtained with the Signal Processing toolbox from MATLAB.

DTIC

*Telecommunication; Satellite Communication; Communication Networks; Microprocessors*

**20020040331** Montana State Univ., Dept. of Physics, Bozeman, MT USA

**Materials for Optical Routers, Signal Processors, and Memories Based on Persistent Spectral Hole Burning *Final Report, 2 Jan. 1998 - 1 Jan 2001***

Cone, Rufus L., Montana State Univ., USA; February 2002; 44p; In English

Contract(s)/Grant(s): F49620-98-1-0171

Report No.(s): AD-A399509; AFRL-SR-BL-TR-02-0070; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Optical signal processing devices using spectral hole burning were demonstrated, including an optical header decoder for packet switching and tests of signal correlator fidelity and phase-shift-keyed codes. New hole burning materials were developed and characterized. Performance improvements of the materials include: (a) multi-GHz bandwidths for signal processors, (b) increased capacity and storage time for data storage, (c) improved frequency stability for lasers stabilized to spectral hole frequency references. The new materials include Er(3+) compounds for 1.5 micron communications bands, Tm(3+), Pr(3+), Eu(3+), and Tb(3+) compounds, mostly in oxide crystal hosts. Tb(3+) compounds were characterized for photon gated persistent spectral hole burning. Electron photoemission spectroscopy was used to determine important relationships between ion levels and host bands and to develop gated persistent hole burning materials; those results have substantial corollary impacts on robustness and efficiency of solid-state laser materials, phosphors for displays, and scintillators for imaging. For all crystal materials - of any symmetry - angular orientation and polarization has been optimized for signal fidelity and fastest transient response in hole burning devices. There were 7 published journal articles, 16 invited presentations, 36 contributed presentations, and participation on 7 conference committees. The project involved five graduate students, nine undergraduates, three postdocs and scientists, along with the Pis. Other AFOSR-supported groups use these materials; Scientific Materials Corp. sells the materials.

DTIC

*Hole Burning; Laser Materials; Optical Materials; Photoelectron Spectroscopy*

**20020040399** Army Cold Regions Research and Engineering Lab., Hanover, NH USA

**Environmentally Dependent Countermeasures to Passive Infrared Detection**

Peck, Lindamae; Lacombe, James; Dec. 1998; 14p; In English; Original contains color images

Report No.(s): AD-A399453; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Simple countermeasures against passive (thermal) infrared intrusion detection systems (IDSs) and thermal imagers were tested in winter by U.S. Army Special Forces soldiers working with personnel of the U. S. Army Cold Regions Research and Engineering Laboratory (CRREL). Under certain site conditions, the countermeasures were very effective, enabling intruders to pass undetected by the infrared IDSs or unnoticed by observers viewing thermal imagery of the site. An awareness of the interplay between environment, countermeasure, and sensor system is crucial both in identifying when a sensor system is vulnerable to countermeasures and in selecting the appropriate countermeasure. This paper explains which environmental factors during the Special Forces/CRREL intrusions determined the success or failure of a countermeasure. It also predicts the general effectiveness of similar countermeasures as a function of the operating environment of a thermal infrared sensor system.

DTIC

*Countermeasures; Thermal Mapping; Infrared Detectors; Low Temperature Environments*

**20020040859** Mitre Corp., Jason Program Office, McLean, VA USA

**Non-GPS Methods of Geolocation**

Cornwall, J.; Case, K.; Callan, C.; Despain, A.; Dyson, F.; Jan. 2002; 25p; In English

Report No.(s): AD-A399515; JSR-00-105; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

JASON was asked to conduct a brainstorming session on the problem of precision (that is, at GPS-like accuracy) geolocation of ground elements by means other than use of GPS satellite transmissions in the usual way. This is important because GPS transmissions are weak and easily jammed, so it may be possible for enemy forces to deny conventional GPS use. We had no briefings on this subject, and (aside from the conventional idea of pseudolites) we are not aware of other work going on in this area. Our work was also limited by the very short time available for this project in the Winter Study, and so we furnish a rather brief report. Our general conclusion is that there are several perfectly practicable schemes for non-GPS geolocation, although more detailed investigation is needed to sort out the various advantages and disadvantages. If DARPA is interested, further studies on the best schemes could be carried out in the Summer Study.

DTIC

*Military Technology; Position Indicators; Position Sensing*

**20020040883** Bolt, Beranek, and Newman, Inc., Arlington, VA USA

**Processor Interface Protocols for Facilitating Detection-Level Data Fusion**

Crouse, Gilbert L., Jr.; Park, John; Nov. 1998; 8p; In English

Report No.(s): AD-A399492; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Sharing track-level contact information across multiple processors and platforms is relatively commonplace now in combat systems. This has been greatly facilitated by the development of communications standards for passing track-level data. However, for more effective data fusion and for operator confirmation purposes, it is often very desirable to share lower level detection and classification data products as well as portions of raw or semi-processed sensor data. Sharing these types of data is often impeded by the need to translate between the different data formats used by the systems involved. Moreover, merely obtaining connectivity between individual stove-piped processing systems is often nontrivial. The work described in this paper is an on-going attempt to develop standard protocols and data formats for communication of lower-level data products between multiple processing systems. The initial effort for this work has been focused on the Under Sea Warfare community, but the protocols are not exclusively applicable to sonar systems.

DTIC

*Multisensor Fusion; Communication Networks; Standards*

**20020040884** Army Communications-Electronics Command, Night Vision and Electronics Sensors Directorate, Fort Belvoir, VA USA

**Sensor Link Protocol: A Common Digital Information Link for Sensor Systems**

Peters, Bill; Meehan, James; Miller, Dennis; Moore, Doug; Mar. 31, 1998; 12p; In English

Report No.(s): AD-A399491; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Program Management Office of Night Vision/Reconnaissance Surveillance and Target Acquisition (NV/RSTA) has developed the Sensor Link Protocol which permits a plug n play like integration of a diverse set of sensors currently or soon to be in production. The Sensor Link Protocol is an RS 485/232 based networking protocol, which allows a variety of sensor systems to be connected to a diverse set of computer platforms. The protocol then provides an interface through which digital information can be passed between the host computer and the sensor as well as a method of externally controlling the sensor functions. The continued emphasis on battlefield digitization and communications has created a means to disseminate accurate and timely information among a variety of battlefield computer systems. These efforts now require the digitally interfacing of Reconnaissance, Surveillance and Target Acquisition (RSTA) sensor systems to these battlefield computer systems. This paper describes and outlines the Sensor Link Protocol which provides a common interface to a variety of RSTA sensor systems. The Sensor Link Protocol acts as an enabling technology linking RSTA sensor systems to the digitized battlefield.

DTIC

*Target Acquisition; Data Links; Digital Systems; Protocol (Computers); Communication*

## ELECTRONICS AND ELECTRICAL ENGINEERING

*Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment and microelectronics and integrated circuitry. For related information see also 60 Computer Operations and Hardware; and 76 Solid-State Physics. For communications equipment and devices see 32 Communications and Radar.*

**20020039304** Army Construction Engineering Research Lab., Champaign, IL USA

**Demonstration and Evaluation of Magnetic Descalers *Final Report***

Smothers, Kent W.; Curtiss, Charles D.; Gard, Brian T.; Strauss, Robert H.; Hock, Vincent F.; Sep. 2001; 104p; In English; Original contains color images

Report No.(s): AD-A399455; ERDC/CERL-TR-01-63; No Copyright; Avail: Defense Technical Information Center (DTIC)

Mineral scale formation in water distribution piping impedes flow, resulting in pressure and volume reduction and increasing operational costs. Chemical cleaning is both costly and time consuming, and there are health concerns when chemically cleaning potable water systems. Some alternatives to chemicals or ion exchange equipment such as water softeners claim to use electric or magnetic fields to change chemical or physical conditions in the water in such a way as to prevent mineral scale buildup. This study conducted a field test of the performance two magnetic and one electronic descalers to determine if the devices would reduce or prevent the formation of mineral scale under field condition. The devices tested did not prevent mineral scale formation under the conditions of this study. The heat exchange capacity of all three shell and tube heat exchangers was considerably reduced by the formation of mineral scale during the course of the study. This study found no significant difference between the devices and the controls in the amount of scale that formed.

DTIC

*Electronic Equipment; Water Treatment; Scale (Corrosion); Magnetic Fields; Electric Fields*

**20020039317** Department of the Navy, Washington, DC USA

**Calibration Circuit for Use with a Differential Input Preamplifier in a Sensor System**

Freehill, Thomas A., Inventor; Straw, Timothy B., Inventor; Aug. 13, 2001; 14p; In English

Patent Info.: Filed 13 Aug. 2001; US-Patent-Appl-SN-09932565

Report No.(s): AD-D019994; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The calibration circuit is used with a differential input, monolithic integrated circuit preamplifier in a sensor system. The calibration circuit tests the integrity of the sensor, the preamplifier, and the wiring in the sensor system. The calibration circuit includes first and second calibration capacitors having different capacitances connected to the preamplifier input leads. A calibration signal source connected between the capacitors. The capacitors are preferably implemented on the same integrated circuit as the preamplifier. In operation, a calibration signal of known amplitude is applied to the calibration circuit and the level at the preamplifier output is determined. The level at the preamplifier output indicates certain conditions relating to the integrity of the sensor and its wiring, for example, an open circuit condition or a short circuit condition.

DTIC

*Preamplifiers; Patent Applications; Circuit Reliability; Calibrating; Capacitors*

**20020039321** Raytheon Systems Co., Dallas, TX USA

**Multispectral HDVIP Focal Plane Arrays**

Keller, R.; Dreiske, P.; Turner, A.; Seymour, B.; Schaake, H.; Jan. 1998; 8p; In English; Original contains color images

Contract(s)/Grant(s): DAAL01-96-1-0001

Report No.(s): AD-A399260; No Copyright; Avail: Defense Technical Information Center (DTIC)

The High-Density Vertically Interconnected Photodiode (HDVIPTM) architecture developed at Texas Instruments is now the basis of staring focal plane arrays fabricated by RTIS FPA Business unit. The architecture has been demonstrated to produce high performance, large area scanning and staring arrays, including the world's first true long-wave (greater than 10 m cutoff) 480x640 staring array. In this paper we report on extending the monochrome HDVIP architecture to multispectral arrays capable of simultaneously detection of 2 or more spectral bands.

DTIC

*Photodiodes; Focal Plane Devices*

**20020039322** NASA Pasadena Office, CA USA

**Inrush Current Control Circuit**

Cole, Steven W., Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Jan. 01, 2002; 7p; In English

Patent Info.: Filed 17 Mar. 2000; US-Patent-6,335,654; US-Patent-Appl-SN-528800; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An inrush current control circuit having an input terminal connected to a DC power supply and an output terminal connected to a load capacitor limits the inrush current that charges up the load capacitor during power up of a system. When the DC power supply applies a DC voltage to the input terminal, the inrush current control circuit produces a voltage ramp at the load capacitor instead of an abrupt DC voltage. The voltage ramp results in a constant low level current to charge up the load capacitor, greatly reducing the current drain on the DC power supply.

Official Gazette of the U.S. Patent and Trademark Office

*Direct Current; Power Supply Circuits; Control Systems Design; Electric Potential*

**20020039333** NASA Ames Research Center, Moffett Field, CA USA

**Functionalization of Carbon Nanotubes using Atomic Hydrogen**

Khare, Bishun N., Search for Extraterrestrial Intelligence Inst., USA; Cassell, Alan M., Eloret Corp., USA; Nguyen, Cattien V., Eloret Corp., USA; Meyyappan, M., NASA Ames Research Center, USA; Han, Jie, Eloret Corp., USA; [2001]; 10p; In English Contract(s)/Grant(s): RTOP 755-30-01; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have investigated the irradiation of multi walled and single walled carbon nanotubes (SWNTs) with atomic hydrogen. After irradiating the SWNT sample, a band at 2940/cm (3.4 microns) that is characteristic of the C-H stretching mode is observed using Fourier transform infrared (FTIR) spectroscopy. Additional confirmation of SWNT functionalization is tested by irradiating with atomic deuterium. A weak band in the region 1940/cm (5.2 micron) to 2450/cm (4.1 micron) corresponding to C-D stretching mode is also observed in the FTIR spectrum. This technique provides a clean gas phase process for the functionalization of SWNTs, which could lead to further chemical manipulation and/or the tuning of the electronic properties of SWNTs for nanodevice applications.

Author

*Carbon Nanotubes; Infrared Spectroscopy; Irradiation; Hydrogen; Deuterium*

**20020039540** NASA Ames Research Center, Moffett Field, CA USA

**Carbon Nanotube Scanning Probe for Surface Profiling of DUV and 193 nm Photoresist Pattern**

Nguyen, Cattien V., NASA Ames Research Center, USA; Stevens, Ramsey M. D., Eloret Corp., USA; Barber, Jabulani, NASA Ames Research Center, USA; Han, Jie, Eloret Corp., USA; Meyyappan, M., NASA Ames Research Center, USA; Sanchez, Martha I., International Business Machines Corp., USA; Larson, Carl, International Business Machines Corp., USA; Hinsberg, William D., International Business Machines Corp., USA; [2001]; 1p; In English; SPIE Microlithography Meeting, Unknown; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): RTOP 704-40-32; No Copyright; Avail: Issuing Activity; Abstract Only

The continual scaling down of semiconductors to 100 nm and below necessitates a characterization technique to resolve high aspect ratio features in the nanoscale regime. This paper reports the use of atomic force microscope coupled with high aspect ratio multi-walled carbon nanotube scanning probe tip for the purpose of imaging surface profile of photoresists. Multi-walled carbon nanotube tips used in this work are 5-10 nm in diameter and about a micron long. Their exceptional mechanical strength and ability to reversibly buckle enable to resolve steep, deep nanometer-scale features. Images of photoresist patterns generated by 257 nm interference lithography as well as 193 nm lithography are presented to demonstrate multi-walled carbon nanotube scanning probe tip for applications in metrology.

Author

*Carbon Nanotubes; Imaging Techniques; Photoresists; Semiconductors (Materials); Scanners*

**20020039688** Maribor Univ., Fakulteta za Elektrotehniko Racunalnistvo in Informatiko, Maribor, Slovenia

**Nonlinear Model of Linear Synchronous Reluctance Motor: The Machine Analysis *Nelinearni Model Linearnega Sinhronskega Reluktancnega Motorja: Analiza Stroj***

Stumberger, Gorazd, Maribor Univ., Slovenia; Stumberger, Bojan, Maribor Univ., Slovenia; Dolinar, Drago, Maribor Univ., Slovenia; Electrotechnical Review; 2001; ISSN 0013-5852; Volume 68, No. 5, pp. 247-252; In Slovene; Copyright; Avail: Issuing Activity

Linear Synchronous Reluctance Motors (LSRM), works, and rotary synchronous reluctance motors, works to , are not unknown although they are not common in industrial applications. Authors in the mentioned works use different analytical, experimental and numerical methods to analyse motors, but in none of these works a complete motor analysis is made. This work focuses on the analysis of LSRM flux linkages, thrusts and friction forces in the entire operating range. The analysis is performed using experimental methods and Finite Element Method (FEM) based numerical methods. Experimentally determined positions

and current dependent flux linkages, motor thrusts and friction forces are presented. The experimentally determined and by the Maxwell's Stress Tensor Method calculated thrusts are compared with the thrusts calculated from flux linkages determined experimentally and calculated by the FEM. Results presented show that the calculation of thrusts from flux linkages gives only average values of thrusts. They should be used carefully especially when the accurate position dependent thrusts are required. Results presented in the paper will be used to improve model of the mechanical subsystem and an iron core model of the LSRM.

Author

*Nonlinearity; Mathematical Models; Synchronous Motors; Thrust; Reluctance; Numerical Analysis*

**20020039689** Institute of Occupational Safety, Ljubljana, Slovenia

**Dielectric Breakdown Model in Homogeneous Media Using Adaptable Computational Mesh** *Model Dielektricnega Preboja v Homogenem SRedstvu s Pomocjo Prilagodljive Racunske Mreze*

Berkopec, Ales, Institute of Occupational Safety, Slovenia; Valencic, Vojko, Ljubljana Univ., Slovenia; Electrotechnical Review; 2001; ISSN 0013-5852; Volume 68, No. 5, pp. 260-265; In English; Copyright; Avail: Issuing Activity

We present our latest model of lightning process. The model has two main advantages: computations were made using adaptable (e.g. non-fixed) computational mesh and we allowed branching of the stepped leader. The electrodes and the stepped leader were modelled as conductors surrounded by a homogenous dielectric media. We took in account observations of stepped leader in atmosphere and used a quasi-static approach. For different values of particular parameter the results can be interpreted as various kinds of discharges, like corona, cold discharge, and any discharge with branched leader.

Author

*Dielectrics; Mathematical Models; Computational Grids; Lightning; Homogeneity*

**20020039701** Trieste Univ., Electrical Engineering Dept., Italy

**Power Quality Enhancing in Distribution Utilities** *Povecanje Kvalitete Elektricne Energije v Distribucijskih Omrezzjih*

Tosato, Fabio, Trieste Univ., Italy; Quaia, Stefano, Trieste Univ., Italy; Electrotechnical Review; 2001; ISSN 0013-5852; Volume 68, No. 5, pp. 271-276; In English; Copyright; Avail: Issuing Activity

One of the most concerning disturbances affecting power quality are voltage sags. Their major source are short-circuits on the utility lines. Faults many kilometers from the disturbed process will generate a momentary voltage sag in the electrical environment to the end user. A reduction of the short-circuit current magnitude may lead to a substantial power quality improvement because the majority of sensitive industrial processes (including computer system, power electronics and variable speed drives) are capable of riding through a sag of a very limited amplitude. Several solutions for Fault Current Limiters (FCLs) design have been described in the recent scientific literature. Nevertheless, the so far proposed FCLs are complex, expensive and may lead to additional operation problems decreasing the distribution reliability. The paper analyses and discusses a possibility of fault current reduction by means of simple permanent reactors and no control circuits, so as to intrinsically overcome most of the above cons.

Author

*Electric Potential; Power Limiters; Quality Control; Utilities*

**20020039714** NASA Goddard Space Flight Center, Greenbelt, MD USA

**AEA Technologies Battery Cell By-pass Device Activation: An Update**

Keys, Denney, NASA Goddard Space Flight Center, USA; Rao, Gopalakrishna M., NASA Goddard Space Flight Center, USA; Sullivan, David, NASA Goddard Space Flight Center, USA; Wannemacher, Harry, QSS Group, Inc., USA; [2001]; 23p; In English; 2001 NASA Aerospace Battery Workshop, 27-29 Nov. 2001, Huntsville, AL, USA; Sponsored by NASA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objectives are to: (1) Verify the Performance of AEA Cell Bypass Protection Device (CBPD) under simulated EOS-Aqua/Aura flight hardware configuration; (2) Assess the Safety of the hardware under an inadvertent firing of CBPD switch, as well as the closing of CBPD switch under simulated high cell impedance; and (3) Confirm that the mode of operation of CBPD switch is the formation of a continuous low impedance path (a homogeneous low melting point alloy).

Derived from text

*Electric Batteries; Bypasses; Impedance; Melting Points*

**20020039716** Ljubljana Univ., Fakulteta za Elektrotehniko, Ljubljana, Slovenia

**A 20 GHz Optoelectronic Phase-Locked Loop** *Optoelektronska Fazno Sklenjena Zanka za Frekvenco 20 GHz*

Vehovc, Samo, Ljubljana Univ., Slovenia; Electrotechnical Review; 2001; ISSN 0013-5852; Volume 68, No. 5, pp. 300-305; In Slovene; Copyright; Avail: Issuing Activity

The paper describes operation and design of an optoelectronic phase-locked loop. The optoelectronic phase-locked loop consists of a fast optoelectronic phase detector operating in the optical domain. The rest of the optoelectronic phase locked loop is made of conventional electronic devices. The task of the optoelectronic phase detector is to detect the phase difference between the modulation of an optical input signal into the phase detector and frequency multiple of a voltage controlled oscillator signal. The optoelectronic phase detector should in principle operate faster than the conventional electronic phase detectors. The optoelectronic phase-locked loop is mainly used as a clock recovery device in optical time division multiplexed (OTDM) systems. The bit rates of OTDM data signals reach 160 Gb/s. At these bit rates it is difficult to construct conventional electronic phase detectors. As a clock recovery device the optoelectronic phase-locked loop locks itself on the discrete spectral line at the clock frequency in the OTDM data signal. The output signal of the phase-locked loop is synchronized with the clock of the input data signal and prescaled to the lower frequency. The extracted prescaled clock is used for demultiplexing the OTDM signal.

Author

*Optoelectronic Devices; Phase Locked Systems; Optical Communication; Time Division Multiplexing; Superhigh Frequencies*

**20020039717** Ljubljana Univ., Fakulteta za Elektrotehniko, Ljubljana, Slovenia

**Speed Sensorless Vector Control of an Induction Machine** *Brezsenzorska Regulacija Vrtilne Hitrosti Asinhronskega Motorja*

Petkovsek, Marko, Ljubljana Univ., Slovenia; Ambrozic, Vanja, Ljubljana Univ., Slovenia; Voncina, Danijel, Ljubljana Univ., Slovenia; Nastran, Janez, Ljubljana Univ., Slovenia; *Electrotechnical Review*; 2001; ISSN 0013-5852; Volume 68, No. 5, pp. 253-259; In Slovene; Copyright; Avail: Issuing Activity

The paper presents a possible concept for a sensorless induction machine (IM) drive fed by a synchronized on-off voltage source inverter with a controlled output LC filter. Unlike conventional time-discrete inverters, where transistors are switched according to the difference between the reference and actual load current, the proposed current control scheme uses the capacitor current difference. In this way, the output voltage is attained indirectly through an impressed filter capacitor current. In the case of sinusoidal capacitor current, the output voltage is sinusoidal and therefore no longer of a discrete shape. This becomes relevant when sensorless IM vector control is to be implemented. Namely, for sensorless speed control besides some IM parameters also the stator voltage and current have to be measured. Based on mathematical expressions of a current and voltage fed IM, a model for calculation of the IM speed is defined. A speed control scheme of the microcomputer controlled IM drive is presented, too. The proposed concept, which exhibits very promising results, was verified through simulation and experimental tests.

Author

*Directional Control; Speed Control; Induction; Microcomputers; Mathematical Models*

**20020039728** Ljubljana Univ., Faculty of Electrical Engineering, Ljubljana, Slovenia

**Calibration of a Reference Field Coil by Means of the NMR Magnetometer and Induction Coils** *Kalibracija Referencne Tuljave s Pomocjo NMR Magnetometra in Indukcijskih Tuljavic*

Gersak, Gregor, Ljubljana Univ., Slovenia; Humar, Janez, Ljubljana Univ., Slovenia; Fefer, Dusan, Ljubljana Univ., Slovenia; *Electrotechnical Review*; 2001; ISSN 0013-5852; Volume 68, No. 5, pp. 294-299; In English; Copyright; Avail: Issuing Activity

Field coils are widely utilized in every precision measurement using stable reference magnetic fields. The basic property defined for any such coil is the coil-constant. It is a quotient of the generated magnetic flux density in the center of the coil and its energizing current. Field coils with a very accurately determined coil-constant are commonly used as a reference magnetic flux standard. By measuring the current energizing the coil the reference magnetic flux density is generated, providing the coil-constant is well known. The accuracy of the generated reference field thus depends mainly on the uncertainty of the coil-constant. In this paper, a calibration procedure for determining the coil-constant of a cylindrical field coil is described. Determination of coil properties in AC and DC conditions is shown. The coil DC constant is determined by employing a nuclear magnetic resonance (NMR) magnetometer used as a magnetic field standard. In AC conditions the frequency dependence of the DC constant is measured by using induction coils.

Author

*Calibrating; Field Coils; Magnetometers; Nuclear Magnetic Resonance; Magnetic Fields*

**20020039860** NASA Ames Research Center, Moffett Field, CA USA

**Computational Modeling in Plasma Processing for 300 mm Wafers**

Meyyappan, Meyya, NASA Ames Research Center, USA; [1997]; 1p; In English; 3rd International Conference on Reactive Plasmas, 21-24 Jan. 1997, Nara, Nara, Japan, Japan

Contract(s)/Grant(s): RTOP 199-61-99; No Copyright; Avail: Issuing Activity; Abstract Only

Migration toward 300 mm wafer size has been initiated recently due to process economics and to meet future demands for integrated circuits. A major issue facing the semiconductor community at this juncture is development of suitable processing equipment, for example, plasma processing reactors that can accommodate 300 mm wafers. In this Invited Talk, scaling of reactors will be discussed with the aid of computational fluid dynamics results. We have undertaken reactor simulations using CFD with reactor geometry, pressure, and precursor flow rates as parameters in a systematic investigation. These simulations provide guidelines for scaling up in reactor design.

Author

*Computational Fluid Dynamics; Plasmas (Physics); Wafers; Migration; Flow Velocity*

**20020040062** Office of the Secretary of Defense, Washington, DC USA

**Report on the Capacitor and Resistor Industry**

Apr. 1998; 65p; In English

Report No.(s): AD-A399281; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Section 854 of the 1998 Defense Authorization Act requires the Department of Defense to conduct a study of the capacitor and resistor industries in the U.S. and to submit to Congress a report on the results of that study by May 1, 1998. The report is to include an assessment of: (1) the U.S. capacitor and resistor industrial base, (2) the impact of relevant tariff reductions required by the December 1996 Information Technology Agreement (ITA), (3) the extent to which the Department of Defense (DoD) is dependent on foreign sources for its resistors and capacitors, and (4) any associated national security implications. Finally, the report is to include recommendations for appropriated changes, if any, in defense procurement policies or other federal policies necessary to address identified national security concerns.

DTIC

*Resistors; Capacitors; Industries*

**20020040340** Saddleback Aerospace Corp., Huntington Beach, CA USA

**Micro-Flow Studies in the 1 to 50 Micron Domain Final Report, Sep. 1998-Sep 2001**

Campbell, Geogrey; Underwood, David; Leung, Brian; Paquette, David; Nelson, Richard; Aug. 2001; 142p; In English

Contract(s)/Grant(s): F30602-98-C-0146; AF Proj. E117

Report No.(s): AD-A399527; AFRL-IF-RS-TR-2001-160; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This effort addressed fundamental issues in the characterization of the flow and heat transfer behavior of micro-systems while at the same time providing an experimental database to reduce the need for scaling (typically 2-3 orders of magnitude) from available macroscopic correlations. The study began with the establishment of sample fabrication and testing techniques, and then progressed to actual thermal and flow measurements on the samples. During the program the following measurements were made: Friction factors ( $f$ ) and transition Reynolds numbers (Retransition) for 24 straight channels of varying surface roughness, using water, air, and FC-72; Minor loss coefficients ( $K_{minor}$ ) for 4 channels with Wyes, 4 channels with T's, and 32 channels with bends of varying aspect ratios and sharpnesses, using water, air, and FC-72; and Nusselt numbers ( $Nu$ ) for 4 channel sizes using water and air. Notably, the experimental results showed that the transition Reynolds number and friction factors for smooth ducts gave no indication of any unusual effects at microscales, but that increasing the wall roughness tended to increase the friction factor and reduce the transition Reynolds number.

DTIC

*Fabrication; Flow Measurement; Microelectromechanical Systems; Laminar Flow; Surface Roughness*

**20020040341** Tanner Research, Inc., Pasadena, CA USA

**Next Generation MEMS Design Tools Final Report, Oct. 1996-Dec. 1999**

Dyne, Barry; Oct. 2001; 62p; In English

Contract(s)/Grant(s): F30602-96-2-0311; AF Proj. E117

Report No.(s): AD-A399526; AFRL-IF-RS-TR-2001-201; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective for this project has been to lower the barriers to MEMS technology through the development of an integrated suite of CAD tools for mixed technology design. Tanner has achieved new levels of integration of layout, solid modeling, and finite element analysis for MEMS device design and verification. Tanner has developed a modeling tool that generates a solid model directly from the layout and a process description. Tanner has also developed a novel approach to MEMS device meshing, dramatically improving the efficiency of finite element analysis. System design tools developed include mixed technology schematic, simulation, place and route, extraction and design rule checking. These tools enable the design, physical layout, and validation of chips of mixed MEMS/IC components. Simulation tools allow the use of a variety of models including C-code, Spice, and MATLAB, necessary for the design of mixed technology chips. A library of components contains a schematic, simulation,

and layout representation of each device, and device layout may be synthesized from functional or geometric parameters. The tools have been demonstrated at a number of commercial and government sites, and are now in commercial release.

DTIC

*Microelectromechanical Systems; Software Development Tools; Computerized Simulation; Systems Engineering*

**20020040397** Northrop Grumman Corp., Linthicum, MD USA

**Development and Characterization of a Greater Than 1 kV Power Electronic Capacitor for Greater Than 300 C Operation**

Bowers, J.; Mandelcorn, L.; Gurkovich, S.; Radford, K.; Jan. 1997; 9p; In English; Prepared in cooperation with Custom Electronics, Oneonta, NY and Mandelcon (Lynn), Pittsburgh, PA

Report No.(s): AD-A399444; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Currently, a large suite of electronic systems used in commercial and industrial applications (which include, but are not limited to, automotive, nuclear power, and well logging systems) require cycle-life performance that would benefit significantly from components designed and optimized for higher temperatures (20 deg C to 60 deg C) under harsh environmental conditions. This paper presents the development, characteristics and life tests of a greater than 1 kv, greater than 30 deg C reconstituted mica paper power electronics capacitor system, including a full-size 2.4 microfarad unit. It should be noted that reconstituted mica paper capacitors are used in a variety of applications, and that they are particularly well suited for use in high voltage, high temperature electronic systems: silicone impregnated mica paper capacitors are available for operation at 260 deg C.

DTIC

*Mica; Capacitors*

**20020040568** Materials Research Society, Warrendale, PA USA

**Ferroelectric Thin Films IX. Volume 655. Symposium Held in Boston, MA on November 26-30, 2000**

McIntyre, Paul C.; Gilbert, Stephen R.; Miyasaka, Yoichi; Schwartz, Robert W.; Wouters, Dirk; Jan. 2001; 502p; In English; Prepared in collaboration with Stanford Univ. Stanford, CA; Agilent Labs., Palo Alto, CA; NEC Corp. Sagamihara, Japan; Clemson Univ. SC; IMEC Leuven, Belgium. Pub. in Materials Research Society Symposium Proceedings Vol. 655

Report No.(s): AD-A399316; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

This symposium, Ferroelectric Thin Films IX, held November 26-30 at the 2000 MRS Fall Meeting in Boston, Massachusetts, was the ninth in a series of highly successful MRS symposia on this topic. Understanding ferroelectric thin films through use of novel and sophisticated characterization methods was an important theme in this edition of the symposium series. Both oral and poster presentations at the symposium described recent advances in scanning probe imaging methods and analysis techniques, electrical characterization methods, and x-ray and TEM-based probes of ferroelectric thin films. In addition, several presentations reviewed progress in the technology of ferroelectric thin films for use in semiconductor memories, piezoelectric devices, and other applications. The technical quality of the contributed presentations was evidenced by the awarding of Poster Awards by the 2000 Fall Meeting chairs to two posters in this symposium, a rare honor.

DTIC

*Thin Films; Ferroelectric Materials; Conferences; Progress; Imaging Techniques*

**20020040790** Pittsburgh Univ., Pittsburgh, PA USA

**Associative Memory Study: Architectures and Technology Final Report, Sep. 1999-Aug. 2000**

Levitani, Steven P.; Chiarulli, Donald M.; Katsuri, Amirtha; Kettering, Joan; Jan. 2002; 110p; In English

Contract(s)/Grant(s): F30602-99-1-0556; AF Proj. PMEM

Report No.(s): AD-A399483; AFRL-IF-RS-TR-2001-264; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report summarizes current work in technologies and architectures for associative or "content addressable" memory. Associative memory is better suited for several specific tasks such as database applications than conventional memory. However, its higher cost and complexity has, until now, limited its use to small, special purpose applications such as translation look-aside buffer used in a computer virtual memory system or network router tables. The conclusions indicate the using new optical technology in associative processors is a promising approach.

DTIC

*Architecture (Computers); Associative Memory; Optical Data Storage Materials*

**20020040800** University of Central Florida, Center for Research In. Electro-optics and Lasers, Orlando, FL USA

**Antenna-Coupled Uncooled Infrared Focal Plane Arrays: In-house Fabrication Final Report, 1 May 2000-26 Feb. 2002**

Boreman, Glenn; Feb. 26, 2002; 4p; In English; Original contains color images

Contract(s)/Grant(s): N00014-00-1-0712

Report No.(s): AD-A399579; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Under the support of the subject DURIP grant, University of Central Florida CREOL has developed an in-house capability for direct-write electron-beam fabrication of the microantenna coupled infrared sensors being investigated for contract to BMDO. The facility developed has resulted in shorter turn-around times for exploration of new device designs while giving a greater degree of process control. Establishment of this facility at CREOL has provided a cost-effective means for prototype device development for infrared focal-plane array applications.

DTIC

*Fabrication; Antennas; Infrared Radiation; Infrared Detectors; Focal Plane Devices*

**20020040806** Pennsylvania State Univ., Dept. of Chemistry, University Park, PA USA

**Inorganic Self-Assembly Routes to Three-Dimensional Memories and Logical Mesostructures** *Final Report, 25 Sep. 1998-31 Mar. 2001*

Mallouk, Thomas E.; Natan, Michael J.; Mayer, Theresa S.; Jackson, Thomas N.; Zhange, Z. J.; Mar. 05, 2002; 12p; In English; Prepared in collaboration with Georgia Institute of Technology, Atlanta, GA and the Institute for Physical Sciences, Santa Fe, NM  
Contract(s)/Grant(s): N00014-98-1-0846

Report No.(s): AD-A399581; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This work sought to develop chemical components and self-assembly techniques for molecular electronic circuits. Specific objectives were to use membrane replication methods to make segmented metal and semiconductor rod colloids, and to develop techniques for assembling them into cross-point arrays for functional circuits. The major accomplishments were demonstration of nanowire synthesis down to diameters of 12 nm with aspect ratios exceeding 100, development of an electrofluidic technique for aligning and measuring the electronic conductivity of individual wires, and development of chemical control over the assembly of nanowires. The latter involved orthogonal self-assembly of molecules onto electrochemically defined V stripes' along the wire length. Using DNA base pairing, suitably striped wires could be assembled into cross- and T-junctions, and onto lithographically defined patterns on surfaces. Methods were developed for layer-by-layer growth of concentric shells of insulators and conducting polymers on the nanowire walls. This allows the crossing of insulated wires without shorts and crossing of functionalized wires for memory or logic function. Fluidic techniques were developed for making 2-D arrays of nanowires assemble into ordered rafts in microwells. Together these advances provide potentially useful materials and techniques for the realization of very dense (more than 10 billion devices per square centimeter) self-assembled electronic circuits.

DTIC

*Three Dimensional Models; Molecular Electronics; Nanostructures (Devices); Conducting Polymers; Self Assembly; Circuits*

**20020040813** Michigan Univ., Ann Arbor, MI USA

**Alaska Meeting on Fundamental Optical Processes in Semiconductors** *Final Report, 1 Jun.-31 2001-2 May 2002*

Norris, Theodore B.; May 31, 2002; 97p; In English

Contract(s)/Grant(s): F49620-01-1-0421

Report No.(s): AD-A399697; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

With support from AFOSR, ONR, and NSF (through CUOS), the Alaska Meeting on Fundamental Optical Processes in Semiconductors (AMFOPS) was held in Girdwood Alaska, Aug. 5-10, 2001. The meeting was highly successful (many of the attendees have informed me that this was the best conference they have attended in years). The goal of the conference was to bring together the leading international groups working in semiconductor optics in a workshop format to present the most recent exciting results, and to discuss the future directions of the field. A major emphasis was place on having a strong US presence (since most of the significant conferences in the field have been held in Europe or Asia in recent years), and almost all the active U.S. groups were represented.

DTIC

*Semiconductors (Materials); Optical Data Processing*

**20020040815** Alabama Univ., Center for Automation and Robotics, Huntsville, AL USA

**Management and Operation of the Production Engineering Division Stereolithography (SL) Laboratory** *Final Report, 29 Sep. 2000-30 Sep 2001*

Paxton, Joseph; Sep. 2001; 4p; In English

Contract(s)/Grant(s): DAAH01-98-D-R001

Report No.(s): AD-A399694; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of the work performed under this task order was to provide engineering support in producing SL prototypes for the PED customers.

DTIC

*Lithography; Production Engineering*

**20020040816** Loyola Coll., Baltimore, MD USA

**Electronics Manufacturing in Hong Kong and China Final Report, Jul. 1999-31 Oct. 2000**

Boulton, W.; Oct. 31, 2000; 159p; In English

Contract(s)/Grant(s): N00014-99-1-0823

Report No.(s): AD-A399699; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This final report of ITRI's panel of experts consists of an executive summary, an introductory chapter, and four chapters by panelists on various aspects of electronics manufacturing. The report also contains site reports for the various companies, labs, universities, and government offices that the panel visited in Hong Kong and China. Comparisons are made between developments in Hong Kong, China and the USA.

DTIC

*Electronic Equipment; Manufacturing; Hong Kong; China*

**20020040819** Vanderbilt Univ., Nashville, TN USA

**Radiation Sources for Total-Dose Testing of Electronics Final Report, 1 Apr. 2000-31 Jul. 2001**

Schrumpf, Ronald D.; Feb. 20, 2002; 18p; In English

Contract(s)/Grant(s): F49620-00-1-0238

Report No.(s): AD-A399705; Rept-4-22-421-4122; AFRL-SR-BL-TR-02-0089; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two Shepherd Model 89 cesium-137 gamma-ray irradiators were acquired and installed at Vanderbilt University. Safety inspections were performed and appropriate monitoring equipment was put in place. The sources provide capability for irradiating electronic devices at relatively - low dose rates, which is important for understanding important device-level degradation effects, including the Enhanced Low-Dose-Rate Sensitivity (ELDRS) of bipolar integrated circuits and long-term degradation and in-situ annealing of MOS integrated circuits.

DTIC

*Electronic Equipment; Irradiation; Radiation Hardening; Radiation Sources*

## 34

### FLUID MECHANICS AND THERMODYNAMICS

*Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also 02 Aerodynamics.*

**20020039142** NASA Ames Research Center, Moffett Field, CA USA

**Real-Time Visualization of an HPF-based CFD Simulation**

Kremenetsky, Mark, Silicon Graphics, Inc., USA; Vaziri, Arsi, NASA Ames Research Center, USA; Haimes, Robert, Massachusetts Inst. of Tech., USA; [1996]; 3p; In English; Parallel CFD 1996, 20-23 May 1996, Capri, Italy; Sponsored by Association for European Research Establishment in Aeronautics, Unknown; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Current time-dependent CFD simulations produce very large multi-dimensional data sets at each time step. The visual analysis of computational results are traditionally performed by post processing the static data on graphics workstations. We present results from an alternate approach in which we analyze the simulation data in situ on each processing node at the time of simulation. The locally analyzed results, usually more economical and in a reduced form, are then combined and sent back for visualization on a graphics workstation.

Author

*Computational Fluid Dynamics; Simulation; Time Dependence*

**20020039314** Department of the Navy, Washington, DC USA

**Pressure-Balanced Gas Turbine Underwater Launcher**

Macleod, Brenda B., Inventor; Moody, Paul E., Inventor; Aug. 20, 2001; 16p; In English

Patent Info.: Filed 20 Aug. 2001; US-Patent-Appl-SN-09932722

Report No.(s): AD-D019997; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

An underwater launcher of a vehicle in a launching tube outside the pressure hull of a submerged launch platform is unaffected by launch depth. A muzzle cap at one end of the tube communicates with ambient water and a ram plate at the other end communicates through openings with ambient water. Rigid elongate segments extend inside the tube between the cap and the plate, and a launch mechanism connected to the platform and tube has an expansion chamber sealed from ambient water and contains a gas driven turbine rotating a pump-inducer communicating through the openings with the ambient water. The pump inducer is adjacent to the plate to simultaneously displace the plate, elongate segments, vehicle, and cap in the tube and eject the vehicle. The plate, elongate segments, and cap decouple from the vehicle as it leaves the tube and safely sink away from the launch platform.

DTIC

*Pressure; Launchers; Underwater Vehicles*

**20020039432** Computer Sciences Corp., Moffett Field, CA USA

**Fluid Flow Visualization**

Lane, David A., Computer Sciences Corp., USA; [1995]; 1p; In English; Fourth SIAM Conference on Geometric Design, 6-9 Nov. 1995, Nashville, TN, USA; Sponsored by Society for Industrial and Applied Mathematics, USA

Contract(s)/Grant(s): RTOP 536-01-50; No Copyright; Avail: Issuing Activity; Abstract Only

Physical phenomena of fluid flows are often analyzed in computational fluid dynamics. With the progress in computer systems, complex 3D time-varying flow simulations are becoming feasible. There are many existing techniques for visualizing fluid flows; however, most of them do not consider the time-dependent nature of the flow. Hence, they may not provide adequate insights to the flow phenomena. New techniques for visualizing time-varying fluid flows are presented.

Author

*Fluid Flow; Computational Fluid Dynamics; Flow Visualization; Physical Factors*

**20020039532** MCAT Inst., CA USA

**RANS-MP: A Portable Parallel Navier-Stokes Solver**

VanderWijngaart, Rob F., MCAT Inst., USA; [1996]; 1p; In English; Third Annual Computational Aerosciences Workshop, 13-15 Aug. 1996, Moffett Field, CA, USA

Contract(s)/Grant(s): NAS2-14109; RTOP 509-10-11; No Copyright; Avail: Issuing Activity; Abstract Only

RANS-MP, a new implementation of a single-grid Navier-Stokes solver using the diagonalized Beam-Warming approximate-factorization scheme, is presented. This first release of the completely rewritten solver employs the following optimizations: (1) Bi-directional multi-partition method for the ADI solver part; this improves granularity and load balance; (2) Improved cache usage through elimination of non-unit-stride array access (possible in part due to multi-partitioning); (3) Preprocessing of communicating boundary conditions to streamline logic during time stepping; (4) Truly parallel, high-performance I/O using the newly-developed MPI-IO library; (5) Elimination of large amounts of redundant operations through efficient use of workspace. Results of some realistic wing computations on the IBM SP2 computer will be presented. We will demonstrate that excellent absolute performance and scalability are obtained with RANS-MP, even for relatively small grid sizes. Besides high performance, an outstanding feature of RANS-MP is its true portability, due to the use of the portable message passing and I/O libraries MPI and MPI-IO.

Author

*Navier-Stokes Equation; Computerized Simulation; Computer Programs*

**20020039550** NASA Langley Research Center, Hampton, VA USA

**Common-Path Heterodyne Laser-Induced Thermal Acoustics for Seedless Laser Velocimetry Final Report**

Hart, Roger C., Institute for Computer Applications in Science and Engineering, USA; Herring, G. C., NASA Langley Research Center, USA; Balla, R. Jeffrey, NASA Langley Research Center, USA; December 2001; 14p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-2001-211252; NAS 1.26:211252; ICASE-2001-37; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We demonstrate the use of a novel technique for the detection of heterodyne laser-induced thermal acoustics signals, which allows the construction of a highly stable seedless laser velocimeter. A common-path configuration is combined with quadrature detection to provide flow direction, greatly improve robustness to misalignment and vibration, and give reliable velocity

measurement at low flow velocities. Comparison with Pitot tube measurements in the freestream of a wind tunnel shows root-mean-square errors of 0.67 m/s over the velocity range 0.55 m/s.

Author

*Flow Velocity; Velocity Measurement; Acoustics; Laser Doppler Velocimeters*

**20020039616** NASA Ames Research Center, Moffett Field, CA USA

**Experimental and Computational Boundary-Layer Studies in a Supersonic Two-Dimensional Nozzle**

Brogan, Toren P., NASA Ames Research Center, USA; King, Lyndell S., NASA Ames Research Center, USA; Reda, Daniel C., NASA Ames Research Center, USA; [1996]; 1p; In English

Contract(s)/Grant(s): RTOP 505-59-50; No Copyright; Avail: Issuing Activity; Abstract Only

Calculations have been carried out on the adiabatic laminar boundary layer developing on the surface of a two-dimensional supersonic nozzle, consisting of contoured nozzle blocks and flat sidewalls. Two- and three-dimensional Navier-Stokes codes, as well as two-dimensional boundary-layer codes have been employed. These codes have been adapted to the characteristics of a specific wind tunnel nozzle, so that their numerical results could be directly compared with experimental data obtained in the same nozzle. Such comparisons have been made for the boundary-layer growth on the contoured nozzle, and for the boundary-layer growth, surface streamlines and surface shear on the sidewalls. The three-dimensional Navier-Stokes code was found to be the only one to correctly predict the mean boundary-layer flow on both the sidewalls and the contoured nozzle. Theory and experiment both indicate that the sidewall flow is highly three-dimensional, with non-uniform shear, corner vortices and a boundary layer strongly distorted by cross flows induced by lateral pressure gradients.

Author

*Supersonic Nozzles; Laminar Boundary Layer; Boundary Layer Flow; Cross Flow*

**20020039692** NASA Ames Research Center, Moffett Field, CA USA

**Characterization of Showerhead Performance At Low Pressure**

Hash, David B., NASA Ames Research Center, USA; Mihopoulos, Ted, NASA Ames Research Center, USA; Meyyappan, Meyya, NASA Ames Research Center, USA; Coronell, Dan, Motorola, Inc., USA; [1999]; 1p; In English; 46th American Vacuum Society International Symposium, Oct. 1999, Seattle, WA, USA; Sponsored by American Vacuum Society, USA

Contract(s)/Grant(s): NAS2-14031; RTOP 632-10-01; No Copyright; Avail: Issuing Activity; Abstract Only

The overall objective of this work is to characterize the flow to rough showerheads by deriving pressure drop versus velocity correlations that can be then used in reactor scale simulations where the showerhead is approximated as a porous medium. At relatively low Reynolds numbers (less than 1-10 based on the hole length scale) and in the absence of slip flow, Darcy's Law,  $\Delta P = \mu U/k$ , can be used to express the relation between the pressure drop and velocity where  $\mu$  is the fluid viscosity and  $k$  is the permeability that can be theoretically predicted as  $k = e R^2 / 8$ , where  $e$  is the porosity. However, at sufficiently small hole diameters and decreased pressures (less than 5 Torr), the Knudsen number based on showerhead tube radius increases, and the flow may be in a transition regime. Different expressions have been proposed to account for this effect in the permeability by expressing  $k$  as a function of either pressure or Knudsen number. But at even higher Knudsen numbers, the pressure drop - velocity dependence is non-linear, and Darcy's Law no longer holds such that a permeability cannot be defined. The direct simulation Monte Carlo method is used along side conventional CFD techniques to determine the extent to which the CFD technique is appropriate and helps to derive correlations for the more rarefied cases of interest in these showerhead flows.

Author

*Low Pressure; Computational Fluid Dynamics; Fluid Flow; Velocity Distribution*

**20020039696** NASA Kennedy Space Center, Cocoa Beach, FL USA

**Heat Transfer Study for HTS Power Transfer Cables**

Augustynowicz, S., DYNACS Engineering Co., Inc., USA; Fesmire, J., NASA Kennedy Space Center, USA; [2002]; 4p; In English; Cryogenics 2002, 15-19 Apr. 2002, Prague, Czechoslovakia

Contract(s)/Grant(s): NAS10-98001; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Thermal losses are a key factor in the successful application of high temperature superconducting (HTS) power cables. Existing concepts and prototypes rely on the use of multilayer insulation (MLI) systems that are subject to large variations in actual performance. The small space available for the thermal insulation materials makes the application even more difficult because of bending considerations, mechanical loading, and the arrangement between the inner and outer piping. Each of these mechanical variables affects the heat leak rate. These factors of bending and spacing are examined in this study. Furthermore, a maintenance-free insulation system (high vacuum level for 20 years or longer) is a practical requirement. A thermal insulation system simulating a section of a flexible HTS power cable was constructed for test and evaluation on a research cryostat. This

paper gives experimental data for the comparison of ideal MLI, MLI on rigid piping, and MLI between flexible piping. A section of insulated flexible piping was tested under cryogenic vacuum conditions including simulated bending and spacers.

Author

*Heat Transfer; High Temperature; Superconductivity; Power Lines; Cryogenics; Thermal Insulation*

**20020039697** Analytical Services and Materials, Inc., Hampton, VA USA

**Transition Documentation on a Three-Element High-Lift Configuration at High Reynolds Numbers--Database**

Bertelrud, Arild, Analytical Services and Materials, Inc., USA; Johnson, Sherylene, NYMA, Inc., USA; February 2002; 60p; In English

Contract(s)/Grant(s): NAS1-96014; RTOP 706-31-11-80

Report No.(s): NASA/CR-2002-211439; NAS 1.26:211439; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A 2-D (two dimensional) high-lift system experiment was conducted in August of 1996 in the Low Turbulence Pressure Tunnel at NASA Langley Research Center, Hampton, VA. The purpose of the experiment was to obtain transition measurements on a three element high-lift system for CFD (computational fluid dynamics) code validation studies. A transition database has been created using the data from this experiment. The present report details how the hot-film data and the related pressure data are organized in the database. Data processing codes to access the data in an efficient and reliable manner are described and limited examples are given on how to access the database and store acquired information.

Author

*Data Bases; High Reynolds Number; Lift; Boundary Layer Transition; Hot-Film Anemometers*

**20020039699** NASA Ames Research Center, Moffett Field, CA USA

**Task Assignment Heuristics for Distributed CFD Applications**

Lopez-Benitez, N., Texas Technological Univ., USA; Djomehri, M. J., NASA Ames Research Center, USA; Biswas, R., NASA Ames Research Center, USA; [2001]; 12p; In English; ICPP 2001 HPSECA Workshop, 3-7 Sep. 2001, Valencia, Spain; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

CFD applications require high-performance computational platforms: 1. Complex physics and domain configuration demand strongly coupled solutions; 2. Applications are CPU and memory intensive; and 3. Huge resource requirements can only be satisfied by teraflop-scale machines or distributed computing.

Derived from text

*Computational Fluid Dynamics; Heuristic Methods; Mathematical Models*

**20020039708** NASA Kennedy Space Center, Cocoa Beach, FL USA

**Corrections for Convective Heat Flux Gauges Subjected to a Surface Temperature Discontinuity**

Kandula, M., DYNACS Engineering Co., Inc., USA; Reinarts, T., NASA Kennedy Space Center, USA; [2002]; 12p; In English; AIAA/ASME Thermophysics and Heat Transfer Conference, 24-27 Jun. 2002, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS10-98001

Report No.(s): AIAA Paper 2002-3087; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A two-dimensional Navier-Stokes computational fluid dynamics (CFD) analysis has been carried out in an effort to determine the convective heat transfer corrections for circular heat flux gauges subjected to a surface temperature discontinuity. Solutions were obtained at a Reynolds number of  $1 \times 10^6$  and a Mach number of 4. The CFD results are compared with the existing correlations for the correction factors. In general, the CFD corrections exceed those provided by the correlations. The discrepancy increases with increasing upstream surface temperature, thus indicating the role of property variations, which are not accounted for in the correlations. A quasi-two-dimensional analysis is also performed to treat the cylindrical geometry of the heat flux gauges by area-averaging the computed two-dimensional results from CFD.

Author

*Convective Heat Transfer; Computational Fluid Dynamics; Heat Flux; Surface Temperature; Measuring Instruments*

**20020039725** NASA Kennedy Space Center, Cocoa Beach, FL USA

**Real-Time Quantitative Analysis of H<sub>2</sub>, He, O<sub>2</sub>, and Ar by Quadrupole Ion Trap Mass Spectrometry**

Ottens, Andrew K., Florida Univ., USA; Harrison, W. W., Florida Univ., USA; Griffin, Timothy P., DYNACS Engineering Co., Inc., USA; Helms, William R., NASA Kennedy Space Center, USA; [2002]; 29p; In English

Contract(s)/Grant(s): NAS10-98001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The use of a quadrupole ion trap mass spectrometer for quantitative analysis of hydrogen and helium as well as other permanent gases is demonstrated. The customized instrument utilizes the mass selective instability mode of mass analysis as with commercial instruments; however, this instrument operates at a greater RF trapping frequency and without a buffer gas. With these differences, a useable mass range from 2 to over 50 Da is achieved, as required by NASA for monitoring the Space Shuttle during a launch countdown. The performance of the ion trap is evaluated using part-per-million concentrations of hydrogen, helium, oxygen and argon mixed into a nitrogen gas stream. Relative accuracy and precision when quantitating the four analytes were better than the NASA-required minimum of 10% error and 5% deviation, respectively. Limits of detection were below the NASA requirement of 25-ppm hydrogen and 100-ppm helium; those for oxygen and argon were slightly higher than the requirement. The instrument provided adequate performance at fast data recording rates, demonstrating the utility of an ion trap mass spectrometer as a real-time quantitative monitoring device for permanent gas analysis.

Author

*Hydrogen; Helium; Real Time Operation; Oxygen; Argon; Quantitative Analysis; Quadrupoles; Gas Analysis*

**20020039745** Johns Hopkins Univ., Dept. of Chemical Engineering, Baltimore, MD USA

**Marangoni Effects of a Drop in an Extensional Flow: The Role of Surfactant Physical Chemistry *Final Report***

Stebe, Kathleen J., Johns Hopkins Univ., USA; [2002]; 5p; In English

Contract(s)/Grant(s): NAG3-1923; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

While the changes in stresses caused by surfactant adsorption on non-deforming interfaces have been fairly well established, prior to this work, there were few studies addressing how surfactants alter stresses on strongly deforming interfaces. We chose the model problem of a drop in a uniaxial extensional flow to study these stress conditions to model surfactant effects at fluid interfaces, a proper description of the dependence of the surface tension on surface concentration, the surface equation of state, is required. We have adopted a surface equation of state that accounts for the maximum coverage limit; that is, because surfactants have a finite cross sectional area, there is an upper bound to the amount of surfactant that can adsorb in a monolayer. The surface tension reduces strongly only when this maximum coverage is approached. Since the Marangoni stresses go as the derivative of the surface equation of state times the surface concentration gradient, the non-linear equation of state determines both the effect of surfactants in the normal stress jump, (which is balanced by the product of the mean curvature of the interface times the surface tension), and the tangential stress jump, which is balanced by Marangoni stresses. First, the effects of surface coverage and intermolecular interactions among surfactants which drive aggregation of surfactants in the interface were studied. (see Pawar and Stebe, *Physics of Fluids*).

Derived from text

*Adsorption; Deformation; Drop Size; Interfacial Tension; Physical Chemistry; Surface Reactions*

**20020039788** Cornell Univ., Sibley School of Mechanical and Aerospace Engineering, Ithaca, NY USA

**Studies of Gas-Particle Interactions in a Microgravity Flow Cell *Final Report***

Louge, Michel Y., Cornell Univ., USA; Jenkins, James T., Cornell Univ., USA; March 2002; 104p; In English

Contract(s)/Grant(s): NAG3-2112; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The ability to transport particulate materials predictably and efficiently using a flowing gas is likely to play an important role in the development of lunar and Martian environments that are hospitable to humans. Lunar soil contains significant amounts of oxygen, hydrogen and other critical materials that are chemically bound in various minerals. Through appropriate processing, these resources may be recovered for use in propulsion, life support systems and mining operations. Similarly, it is believed that Martian soil contains significant amounts of water which can be electrolyzed into oxygen and hydrogen, again for propellants and life support. The transport of such granular soils from where they are mined and between stages of their processing is likely to involve pneumatic transport carried out in systems of pipes using flows of the liberated gases. On earth, the transport and processing of solid materials are also crucial in a number of applications from the chemical, mining, power and oil industries. For these flows, an appreciation has recently developed for the influence of collisional interactions among particles, both in suspensions where the flow is laminar and turbulent. Collisions between such particles can transfer a significant amount of momentum within the flow and at the boundaries. This provides an additional resistance to the passage of the gas, but it also introduces a mechanism that promotes more homogeneous flows and, at least in small-diameter pipes, may forestall the development of clusters.

Derived from text

*Gas Flow; Particulates; Microgravity; Lunar Environment; Mars Surface; Life Support Systems; Chemical Bonds*

**20020040086** Institute for Computer Applications in Science and Engineering, Hampton, VA USA

**Linear and Nonlinear Instabilities of Blasius Boundary Layer Perturbed by Streamwise Vortices, Part 2, Intermittent Instability Induced by Long-Wavelength Klebanoff Modes Final Report**

Wu, Xue-Song, Institute for Computer Applications in Science and Engineering, USA; Choudhari, Meelan, NASA Langley Research Center, USA; December 2001; 46p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-2001-211424-Pt-2; NAS 1.26:211424-Pt-2; ICASE-2001-45-Pt-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present theoretical results on the stability properties of a Blasius boundary layer perturbed by Klebanoff distortions with a relatively long spanwise scale. Even relatively weak Klebanoff modes can alter the near-wall curvature of the underlying flow by  $O(1)$  and, hence, introduce linear instabilities with larger characteristic growth rates and frequencies than those of the Tollmien-Schlichting waves in an unperturbed Blasius flow. A localized distortion supports both sinuous and varicose modes of instability, with the growth rates of the sinuous modes being likely to be larger, in general. Overall, the instability is intermittent in time and localized in space, being confined to a finite part of the Klebanoff mode cycle and to a specific window(s) along the streamwise direction. A spanwise periodic distortion supports spatially quasi-periodic modes (via the parametric resonance mechanism), which may be viewed as modified T-S waves with excess growth rates when the Klebanoff modes are weak. In spite of the simplifications involved in this theory, its predictions appear qualitatively consistent with some of the unusual characteristics of the high-frequency wavepackets observed during previous experiments. The nonlinear development of a localized sinuous mode is followed across a sequence of asymptotic regimes using the non-equilibrium critical-layer theory.

Author

*Blasius Flow; Boundary Layer Stability; Vortices; Flow Distortion; Computerized Simulation; Computational Fluid Dynamics*

**20020040111** Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA

**The Self-Induction Theory of Vortex Breakdown**

Cain, Charles B.; Kurosaka, Mitsuru; May 23, 2001; 243p; In English; Original contains color images

Report No.(s): AD-A399284; CI02-17; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

A new study of the transient stages leading to the formation of vortex breakdown shows that vortex breakdown is initiated by a negative vorticity gradient that causes an inviscid self-induction feedback mechanism resulting in steady state vortex breakdown. We call this the self-induction theory of vortex breakdown. The vortex filament method captures the evolution of this transient formation of vortex breakdown. An axial vorticity gradient is introduced into the vortex tube by changing the circulation along the tube. Thereafter, the self-induction process starts on its own as the axial vorticity induces azimuthal velocity, which in turn tilts the vorticity vector in the azimuthal direction. Due to the gradient in azimuthal vorticity caused by the increase in circulation, the vortex tube radially expands and the vortex filaments contract in an action we call pile-up. This is followed by a sign switch in the azimuthal vorticity caused by the region downstream of the vorticity gradient rotating slower than the upstream region. These actions proceed together until they form what we call the turning point where the vortex filaments turn inward on themselves causing a sign switch in the axial vorticity. Vorticity and velocity data produced from this simulation compare well to experimental data. In conjunction with the computer simulation, we have verified these results experimentally with a delta wing model in a water tunnel using dye flow visualization, laser-induced fluorescence, and particle image velocimetry. These results, combined with comparisons with previous experiments agree with one another and support the self-induction theory of vortex breakdown.

DTIC

*Vortices; Flow Visualization; Vortex Breakdown; Vortex Filaments*

**20020040330** Aerosoft, Inc., Blacksburg, VA USA

**Hypersonic Maneuvering Vehicle Simulations Using Real-Gas, Unstructured Navier-Stokes Software Final Report, 15 Nov. 1998-14 Nov 2001**

McGrory, William D.; Nov. 14, 2001; 51p; In English

Contract(s)/Grant(s): F49620-99-C-0001

Report No.(s): AD-A399497; AFRL-SR-BL-TR-02-0060; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Hypersonic vehicles are becoming more of a reality with the current level of technology. Concept vehicles are now being made in order to test the most recent advances in hypersonic technology. Along with models for flight testing, CFD has become an important role in the development of modern hypersonic vehicles. The technology in CFD is making more complex

configurations and flow-fields available for simulation. One of the advances in CFD that is making this possible is unstructured grid generation and flow solvers.

DTIC

*Computational Fluid Dynamics; Hypersonic Flow; Grid Generation (Mathematics); Navier-Stokes Equation*

**20020040799** SRI International Corp., Menlo Park, CA USA

**Advanced Stimulated Scattering Measurements in Supercritical Fluids** *Final Report, 1 Feb.-31 Oct. 2001*

Faris, Gregory W.; Jan. 2002; 43p; In English

Contract(s)/Grant(s): F49620-01-C-0020; Proj-2308

Report No.(s): AD-A399684; SRI-MP-02-003; AFRL-SR-BL-TR-02-0073; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Stimulated Brillouin and Rayleigh scattering was applied to measurements of supercritical fluids. Measurements were performed using an injection-locked Nd:YAG laser as a pump laser and an external cavity diode laser as a probe laser. Improvements were made in stability of the probe laser, allowing more reliable operation and in the stability of the pump laser, allowing narrower bandwidth operation. Improvements were made to a supercritical cell to allow measurements in the near critical region. Software was written to enable automated analysis of measured spectra to extract the widths, shifts, and heights of the electrostrictive Brillouin, thermal Brillouin, and thermal Rayleigh peaks. Comparison of these features with theory has showed consistency of the theory through the relationships between the heights and widths of the thermal Brillouin and thermal Rayleigh peaks. Elastic and thermal properties extracted from the measurements agree with literature values for room temperature and atmospheric pressure conditions. Brillouin and Rayleigh measurements were performed over a wide range of supercritical and near-critical conditions. Interesting, unexpected structure in the behavior of the Brillouin shifts, width, and heights was observed in the supercritical region.

DTIC

*Supercritical Fluids; Supercritical Flow; Rayleigh Scattering; Brillouin Effect*

**20020040818** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**Drop/Gas Interactions of Dense Sprays** *Final Report, 1 Apr. 1999-30 Sep. 2001*

Faeth, G. M.; Nov. 15, 2001; 155p; In English

Contract(s)/Grant(s): F49620-99-1-0083; AF Proj. 2308

Report No.(s): AD-A399707; GDL/GMF-01/01; AFRL-SR-BL-TR-02-0090; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Turbulence generation and secondary drop breakup were studied. Turbulence generation is due to the motion of high-speed dispersed phases through continuous phases. Secondary drop breakup intrinsically follows primary liquid breakup in sprays. Measurements showed that flows caused by turbulence generation consisted of dispersed phase wakes (involving laminar-like turbulent wakes) surrounded by a turbulent interwake region involving isotropic turbulence in the final decay region. These measurements provided information about the properties of both of these regions. Measurements also provided the temporal properties of secondary drop deformation and breakup for shock wave disturbances at large liquid-gas density ratios. Numerical simulations yielded corresponding information at conditions more representative of practical combustion chambers that would be difficult to address with physical experiments.

DTIC

*Turbulent Flow; Sprayers*

## 35

### INSTRUMENTATION AND PHOTOGRAPHY

*Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Avionics and Aircraft Instrumentation; and 19 Spacecraft Instrumentation.*

**20020039145** North Carolina Agricultural and Technical State Univ., Dept. of Mechanical Engineering, Greensboro, NC USA

**Combustion Sensors: Gas Turbine Applications** *Final Report*

Human, Mel, North Carolina Agricultural and Technical State Univ., USA; [2002]; 33p; In English; Diskette: 1 3.5-Inch DSHD diskette containing full text document in PDF format

Contract(s)/Grant(s): NAG2-1430; No Copyright; Avail: CASI; A03, Hardcopy

This report documents efforts to survey the current research directions in sensor technology for gas turbine systems. The work is driven by the current and future requirements on system performance and optimization. Accurate real time measurements of velocities, pressure, temperatures, and species concentrations will be required for objectives such as combustion instability attenuation, pollutant reduction, engine health management, exhaust profile control via active control, etc. Changing combustor conditions - engine aging, flow path slagging, or rapid maneuvering - will require adaptive responses; the effectiveness of such will be only as good as the dynamic information available for processing. All of these issues point toward the importance of continued sensor development. For adequate control of the combustion process, sensor data must include information about the above mentioned quantities along with equivalence ratios and radical concentrations, and also include both temporal and spatial velocity resolution. Ultimately these devices must transfer from the laboratory to field installations, and thus must become low weight and cost, reliable and maintainable. A primary conclusion from this study is that the optics-based sensor science will be the primary diagnostic in future gas turbine technologies.

Derived from text

*Combustion; Combustion Stability; Gas Turbines; Optical Measuring Instruments; Technology Assessment*

**20020039313** Department of the Navy, Washington, DC USA

**Fiber Optic Pitch or Roll Sensor**

Ames, Gregory H., Inventor; Oct. 15, 2001; 14p; In English

Patent Info.: Filed 15 Oct. 2001; US-Patent-Appl-SN-09983-047

Report No.(s): AD-D019999; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The present invention relates to a fiber optic sensing device having utility as a roll sensor and/or a pitch sensor. The sensing device comprises at least one optical fiber supported in a structure, a movable mass supported within the structure, and at least one detector for detecting changes in tension in at least one optical fiber due to movement of the movable mass. In the sensor of the present invention, the optical fiber(s) are the only deformable structures, thus maximizing sensitivity.

DTIC

*Fiber Optics; Optical Measuring Instruments*

**20020039435** NASA Ames Research Center, Moffett Field, CA USA

**Measurements of Holographic Properties of Bacteriorhodopsin Films**

Downie, John D., NASA Ames Research Center, USA; [1995]; 1p; In English

Contract(s)/Grant(s): RTOP 233-02-05-06; No Copyright; Avail: Issuing Activity; Abstract Only

Several different bacteriorhodopsin (BR) films are characterized with respect to general holographic properties. Experimental measurements include diffraction efficiency and sensitivity as functions of writing intensity and grating frequency, hologram thermal decay behavior, diffraction efficiency as a function of grating tilt within the film and modulation depth, and estimates of the refractive index change from the diffraction efficiency data. The films studied include those made from wildtype BR and the genetic variants D96N and D96N/T46V. The maximum diffraction efficiency measured was just over 3% for a hydrated wildtype BR film. The films' holographic properties were found to be relatively insensitive to grating frequency and grating tilt angle. The diffraction efficiency dropped off more sharply as a function of modulation depth than a purely linear medium, and only the hydrated wildtype film exhibited significant behavior variation with different writing intensities.

Author

*Bacteria; Photoreceptors; Holography; Temperature Effects; Modulation; Depth; Proteins*

**20020039713** Caelum Research Corp., Moffett Field, CA USA

**Formal Models of Blur Detection**

Neveu, Charles F., Caelum Research Corp., USA; [1999]; 24p; In English; European Conference on Visual Perception, Unknown Contract(s)/Grant(s): NAS2-14217; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a review and comparison of the engineering and physiological optics literature on defocus detection. The equivalence of spatial frequency based detectors and the edge-based hypothesis, and variance-based detectors and the contrast-difference hypothesis is argued. Finally, variance-invariant transforms are introduced as a means of experimentally differentiating the hypotheses.

Author

*Models; Blurring; Detection; Computer Vision; Transformations (Mathematics)*

**20020039724** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Analysis of the Performance Characteristics of the Five-Channel Microtops II Sun Photometer for Measuring Aerosol Optical Thickness and Precipitable Water Vapor**

Ichoku, Charles, Science Systems and Applications, Inc., USA; Levy, Robert, Science Systems and Applications, Inc., USA; Kaufman, Yoram, NASA Goddard Space Flight Center, USA; Remer, Lorraine A., NASA Goddard Space Flight Center, USA; Li, Rong-Rong, Science Systems and Applications, Inc., USA; Martins, Vanderlei J., NASA Goddard Space Flight Center, USA; Holben, Brent N., NASA Goddard Space Flight Center, USA; Abuhassan, Nader, Science Systems and Applications, Inc., USA; Slutsker, Ilya, Science Systems and Applications, Inc., USA; Eck, Thomas F., NASA Goddard Space Flight Center, USA; Pietras, Christophe, Science Applications International Corp., USA; [2001]; 47p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Five Microtops II sun photometers were studied in detail at the NASA Goddard Space Flight Center (GSFC) to determine their performance in measuring aerosol optical thickness (AOT or  $\text{Tau}(\text{sub } \alpha\lambda)$ ) and precipitable column water vapor (W). Each derives  $\text{Tau}(\text{sub } \alpha\lambda)$  from measured signals at four wavelengths  $\lambda$  (340, 440, 675, and 870 nm), and W from the 936 nm signal measurements. Accuracy of  $\text{Tau}(\text{sub } \alpha\lambda)$  and W determination depends on the reliability of the relevant channel calibration coefficient ( $V(\text{sub } 0)$ ). Relative calibration by transfer of parameters from a more accurate sun photometer (such as the Mauna-Loa-calibrated AERONET master sun photometer at GSFC) is more reliable than Langley calibration performed at GSFC. It was found that the factory-determined value of the instrument constant for the 936 nm filter ( $k = 0.7847$ ) used in the Microtops' internal algorithm is unrealistic, causing large errors in  $V(\text{sub } 0(936))$ ,  $\text{Tau}(\text{sub } \alpha 936)$ , and W. Thus, when applied for transfer calibration at GSFC, whereas the random variation of  $V(\text{sub } 0)$  at 340 to 870 nm is quite small, with coefficients of variation (CV) in the range of 0 to 2.4%, at 936 nm the CV goes up to 19%. Also, the systematic temporal variation of  $V(\text{sub } 0)$  at 340 to 870 nm is very slow, while at 936 nm it is large and exhibits a very high dependence on W. The algorithm also computes  $\text{Tau}(\text{sub } \alpha 936)$  as  $0.91\text{Tau}(\text{sub } \alpha 870)$ , which is highly simplistic. Therefore, it is recommended to determine  $\text{Tau}(\text{sub } \alpha 936)$  by logarithmic extrapolation from  $\text{Tau}(\text{sub } \alpha 675)$  and  $\text{Tau}(\text{sub } \alpha 870)$ . From the operational standpoint of the Microtops, apart from errors that may result from unperceived cloud contamination, the main sources of error include inaccurate pointing to the Sun, neglecting to clean the front quartz window, and neglecting to calibrate correctly. If these three issues are adequately taken care of, the Microtops can be quite accurate and stable, with root mean square (rms) differences between corresponding retrievals from clean calibrated Microtops and the AERONET sun photometer being about  $\pm 0.02$  at 340 nm, decreasing down to about  $\pm 0.01$  at 870 nm.

Author

*Water Vapor; Aerosols; Photometers; Optical Thickness; Temporal Distribution*

**20020039727** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Remote Sensing of Non-Aerosol (anomalous) Absorption in Cloud Free Atmosphere**

Kaufman, Yoram J., NASA Goddard Space Flight Center, USA; Dubovik, Oleg, Maryland Univ. Baltimore County, USA; Smirnov, Alexander, Maryland Univ. Baltimore County, USA; Holben, Brent N., NASA Goddard Space Flight Center, USA; [2001]; 4p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The interaction of sunlight with atmospheric gases, aerosols and clouds is fundamental to the understanding of climate and its variation. Several studies questioned our understanding of atmospheric absorption of sunlight in cloudy or in cloud free atmospheres. Uncertainty in instruments' accuracy and in the analysis methods makes this problem difficult to resolve. Here we use several years of measurements of sky and sun spectral brightness by selected instruments of the Aerosol Robotic Network (AERONET), that have known and high measurement accuracy. The measurements taken in several locations around the world show that in the atmospheric windows 0.44, 0.06, 0.86 and 1.02 microns the only significant absorbers in cloud free atmosphere is aerosol and ozone. This conclusions is reached using a method developed to distinguish between absorption associated with the presence of aerosol and absorption that is not related to the presence of aerosol. Non-aerosol absorption, defined as spectrally independent or smoothly variable, was found to have an optical thickness smaller than 0.002 corresponding to absorption of sunlight less than 1W/sq m, or essentially zero.

Author

*Remote Sensing; Aerosols; Absorption; Clouds (Meteorology); Free Atmosphere*

**20020039749** Alabama Univ., Center for Microgravity and Materials Research, Huntsville, AL USA

**ZBLAN Viscosity Instrumentation Annual Report**

Kaukler, William, Alabama Univ., USA; Sep. 27, 2001; 6p; In English

Contract(s)/Grant(s): NCC8-207; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The past year's contribution from Dr. Kaukler's experimental effort consists of these 5 parts: a) Construction and proof-of-concept testing of a novel shearing plate viscometer designed to produce small shear rates and operate at elevated temperatures; b) Preparing nonlinear polymeric materials to serve as standards of nonlinear Theological behavior; c) Measurements and evaluation of above materials for nonlinear rheometric behavior at room temperature using commercial spinning cone and plate viscometers available in the lab; d) Preparing specimens from various forms of pitch for quantitative comparative testing in a Dynamic Mechanical Analyzer, Thermal Mechanical Analyzer; and Archeological Analyzer; e) Arranging to have sets of pitch specimens tested using the various instruments listed above, from different manufacturers, to form a baseline of the viscosity variation with temperature using the different test modes offered by these instruments by compiling the data collected from the various test results. Our focus in this project is the shear thinning behavior of ZBLAN glass over a wide range of temperature. Experimentally, there are no standard techniques to perform such measurements on glasses, particularly at elevated temperatures. Literature reviews to date have shown that shear thinning in certain glasses appears to occur, but no data is available for ZBLAN glass. The best techniques to find shear thinning behavior require the application of very low rates of shear. In addition, because the onset of the thinning behavior occurs at an unknown elevated temperature, the instruments used in this study must provide controlled low rates of shear and do so for temperatures approaching 600 C. In this regard, a novel shearing parallel plate viscometer was designed and a prototype built and tested.

Derived from text

*Manufacturing; Glass; Prototypes; Viscosity; Measuring Instruments*

**20020039836** NASA Langley Research Center, Hampton, VA USA

**Aerothermal Instrumentation Loads to Implement Aeroassist Technology in Future Robotic and Human Missions to MARS and Other Locations Within the Solar System**

Parmar, Devendra S., NASA Langley Research Center, USA; Shams, Qamar A., NASA Langley Research Center, USA; April 2002; 44p; In English

Contract(s)/Grant(s): RTOP 713-81-70

Report No.(s): NASA/TM-2002-211459; NAS 1.15:211459; L-18123; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The strategy of NASA to explore space objects in the vicinity of Earth and other planets of the solar system includes robotic and human missions. This strategy requires a road map for technology development that will support the robotic exploration and provide safety for the humans traveling to other celestial bodies. Aeroassist is one of the key elements of technology planning for the success of future robot and human exploration missions to other celestial bodies. Measurement of aerothermodynamic parameters such as temperature, pressure, and acceleration is of prime importance for aeroassist technology implementation and for the safety and affordability of the mission. Instrumentation and methods to measure such parameters have been reviewed in this report in view of past practices, current commercial availability of instrumentation technology, and the prospects of improvement and upgrade according to the requirements. Analysis of the usability of each identified instruments in terms of cost for efficient weight-volume ratio, power requirement, accuracy, sample rates, and other appropriate metrics such as harsh environment survivability has been reported.

Author

*Aeroassist; Aerothermodynamics; Robotics; Technology Utilization; Aerodynamic Loads; Solar System; Manned Mars Missions; Temperature Measuring Instruments*

**20020040049** Department of Defense, Office of the Inspector General, Arlington, VA USA

**DOD Eye Sensors to Give 'Urban Canyon Visibility**

Bender, Bryan; Feb. 16, 2000; 3p; In English

Report No.(s): AD-A399295; IG/DOD-D; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The US Department of Defense (DoD) is considering supplying troops with low-cost, disposable hand-held sensors that can be fused into an intelligence network accessible at the lowest levels on the future urban battlefield. The Smart Sensor Web initiative will initially use \$7 million in science and technology funding and begin testing in August at the US Army's military operations in urban terrain (MOUT) training facility, Ft Benning, Georgia. Project officials want to equip troops with a large number and variety of sensors, such as thousands of acoustic, optical, weather, seismic and magnetic sensors. Such devices will soon be available on the commercial market for as little as \$ 10 each. These sensors, planted around the battlefield by troops, would feed data into a network to give a better battlespace picture than is currently available. "We're focused on the lowest levels of the military, especially in urban combat," said Jasper Lupo, director of sensor systems in the DoD's Science & Technology (S&T) office. He envisions a group of soldiers "moving from building to building placing cameras instead of bombs on the sides of buildings". Present urban-terrain operations use traditional surveillance platforms such as satellites and aircraft. However

shadows and other masking effects make their job difficult. The Smart Sensor Web could deliver "the kind of visibility in urban canyons that we haven't seen before", Lupo said, adding that the Smart Sensor Web will be pursued in incremental steps or "sub-webs".

DTIC

*Visibility; Eye (Anatomy); Military Operations; Surveillance; Cities*

**20020040057** Stanford Univ., Dept. of Civil and Environmental Engineering, Stanford, CA USA

**Characterization and Modeling of Plumes and Animal Plume-Tracing in Wave-Influenced Coastal Environments** *Final Report, 1 Jul. 1998-30 Jun. 2001*

Koseff, Jeffrey R.; Monismith, Stephen G.; Feb. 21, 2002; 7p; In English

Contract(s)/Grant(s): N00014-98-1-0785

Report No.(s): AD-A399263; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This study focused on understanding how peripheral and central encoding of chemical detection signals are accomplished, and determining which spatial and temporal properties of chemical plumes are of most importance to plume-tracing animals. Laboratory experiments were performed to examine the odor-tracing behavior of the stomatopod *H. ensigera* in unidirectional and wave-influenced flow environments, and correlated tracing maneuvers with the simultaneously-recorded characteristics of the odor plume at the position of the animals' olfactory antennules. We also performed a combination field data collection/modeling research program to characterize the dynamics of a plume from a near-bed source in near-coastal waters. It was found that odor plumes in both unidirectional and wave-affected flow consist of very thin filaments of high concentration interspersed with clean water, but odor filaments encountered by the antennules have both a higher maximum odor concentration and a higher mean odor concentration in wave-affected flows. This is the first recording of the exact chemical information an animal is getting as it navigates to a source in a realistic flow environment. The field experiments revealed that the plume's vertical extent is entirely determined by the source height and the thickness of the near bottom mixed layer, which is set by the local stratification.

DTIC

*Marine Biology; Detection; Coastal Water; Marine Chemistry*

**20020040061** Pennsylvania State Univ., Applied Research Lab., University Park, PA USA

**Calibration and Estimate of Oceanographic Sensor Signals** *Final Report, 1 Jul. 1997-30 Jun. 2001*

Ray, Asok K.; Phoha, Shashi; Jan. 30, 2002; 5p; In English

Contract(s)/Grant(s): N00014-97-1-0786

Report No.(s): AD-A399268; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The research conducted under this project has been an extension of an ongoing research effort for development of the Ocean Sampling MOBILE Network (SAMON) Controller. The role of the Ocean SAMON Controller is to support the development of a distributed, high resolution and robust Autonomous Oceanographic Sampling Network (AOSN). The concept of the SAMON Controller is based on a multitude of inexpensive self-organizing autonomous vehicles released by a supply vessel in a certain region of the ocean. The research conducted has focused on formulation of quantitative methods of statistical signal processing for calibration and estimation of oceanographic sensor signals (e.g., conductivity, depth, and temperature). Two graduate students were partially supported by this AASERT (Augmentation Awards for Science and Engineering Research Training) grant.

DTIC

*Signal Processing; Oceanography; Calibrating*

**20020040329** Army Communications-Electronics Command, Night Vision and Electronics Sensors Directorate, Fort Belvoir, VA USA

**Effects of Measurement Geometry on Spectral Reflectance and Color**

Yingst, Austin; Jan. 1998; 8p; In English

Report No.(s): AD-A399498; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Measurements of candidate materials for calibration of outdoor color imagery were made using integrating sphere and 45° geometry. The differing results are discussed using CIELAB linear color space in terms of the measurement geometry and specularities of the material. Implications for calibration of outdoor photography are discussed with an example.

DTIC

*Geometry; Spectral Reflectance; Imagery*

**20020040337** Georgia Inst. of Tech., Atlanta, GA USA

**Correlated UV Through IR Signature Modeling of Targets and Backgrounds**

Stewart, John M.; Goodwin, Robert W.; Higgins, Melinda K.; Patterson, Ed M.; Nov. 1998; 11p; In English; Original contains color images

Report No.(s): AD-A399519; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Simulations of the performance of multi-spectral sensors or multiple sensors with data fusion require phenomenological consistency in the target and background signatures presented to the sensors. This paper describes the incorporation of ultraviolet signatures of targets and backgrounds into an engagement simulation framework. This paper emphasizes ultraviolet phenomenology and the signatures of aircraft compared to fires, lights, industrial sources and other high energy sources. In particular, variation of the sources as a function of time, wavelength and aspect angle is discussed, as these variations may be critical to the discrimination of targets from natural and man-made background sources. The organization of multiple data sets representing the same object in different spectral regions is also described for use in simulations.

DTIC

*Infrared Signatures; Phenomenology; Targets; Ultraviolet Spectra; Computerized Simulation*

**20020040342** Air Force Research Lab., Space Vehicles Directorate, Hanscom AFB, MA USA

**IRTSS Modeling of the JCCD Database**

Luker, Steve; Nov. 1998; 6p; In English; Original contains color images

Report No.(s): AD-A399525; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

AFRL developed Infrared Target-Scene Simulation Software (IRTSS) as a unit-level "through the-sensor" infrared scene prediction capability to aid aircrews and mission planners in the employment of Precision Guided Munitions (PGMs). The system explicitly models the effects of weather, time-of-day, and mission tactics as viewed through the sensor and displayed on the weapon system display scopes. In addition, weapons system efficiency parameters such as detection and lock-on ranges are produced. AFRL has recently integrated a capability for modeling CCD-treated targets. Many simulation capabilities model CCD signatures, but few model target/CCD treatment interactions. IRTSS actually models the influence the target has on its CCD treatment (e.g., high thermal mass target under a camouflage net). This paper presents the preliminary results of an effort using IRTSS to model a particular field-test trial of the JCCD database. Using observed weather obtained through AFCCC and flight path information, IRTSS generated synthetic imagery that was compared to the JCCD mission video. Work ongoing involves using various metrics, human performance models, and photosimulation techniques to determine probability of detection (PD) for both the IRTSS synthetic imagery and the JCCD database imagery.

DTIC

*Charge Coupled Devices; Data Bases; Targets; Computerized Simulation; Mathematical Models; Infrared Radiation*

**20020040367** Center for Remote Sensing, Fairfax, VA USA

**Experimental Demonstration of Underground Structure Characterization Using Sensitive Magnetic Sensors**

Ganguly, Suman; Jan. 29, 1999; 36p; In English

Contract(s)/Grant(s): F19628-98-C-0015; AF Proj. 4268

Report No.(s): AD-A399347; AFRL-VS-TR-1999-1508; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The practical feasibility of detection and characterization of underground structures using electromagnetic sources in the ELF/VLF range is being investigated. For this, we investigate issues associated with sensors. One important objective is to examine the feasibility of using magnetic field measurements alone. We have developed unique 3-D e.m. models which can adequately cover arbitrary geometries, inhomogeneous ground, various excitation schemes and most importantly can handle a wide range of frequencies. We are currently performing numerical simulations using the 3-D e.m. code. We have established the need of 3-D modeling and there are no other codes which allow complete solutions for e.m. problems without any approximations. The results of these simulation will provide the experimental requirements. It is impractical to measure E fields from a stand-off distance. We are pursuing simulations to see if only the magnetic field measurement could provide the desired information. We have developed the most sensitive magnetic sensors which can be used from a remote location (such as from UAV). We plan to use these sensors for practical demonstration of magnetic-field-only measurements.

DTIC

*Underground Structures; Experimentation; Feasibility; Magnetic Fields; Analyzers*

**20020040375** State Univ. of New York, Dept. of Electrical Engineering, Buffalo, NY USA

**Signal Subspace Processing of Uncalibrated MTD-SARs Final Report**

Soumekh, Mehrdad; Feb. 20, 2002; 37p; In English

Contract(s)/Grant(s): N00014-97-1-0966

Report No.(s): AD-A399390; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report provides a study on the merits of the algorithms that we have developed under this contract. For this purpose, we present moving target detection and imaging results for an X band spotlight SAR system that utilizes an along-track monopulse configuration for its data collection. The theoretical foundation of the processing that is used on these data is based on our work for this contract in which a two-dimensional signal subspace processing (adaptive filtering) method was developed to calibrate the monostatic and bistatic radars of the monopulse SAR system. The blind calibration of the two channels enables the user to null the stationary scene, and detect the moving targets. Next, a measure that we call SAR ambiguity function is used to estimate the relative speed of a detected moving target. The resultant estimate is then used to image the moving target.

DTIC

*Synthetic Aperture Radar; Target Acquisition*

**20020040394** Colorado Univ., Optoelectronic Computing Systems Center, Boulder, CO USA

**RF Photonics for Array Processing MURI 3rd Year Summary Annual Report, no. 4, 15 Aug. 2000-15 Aug 2001**

Wagner, Kelvin H.; Anderson, Dana; Popovic, Zoya; Babbitt, Randall W.; Knossen, Andre; Jan. 2001; 118p; In English; Prepared in cooperation with Montana State Univ., Univ. of California, Davis, and George Mason Univ. (Lloyd Griffiths)

Contract(s)/Grant(s): N00014-97-1-1006

Report No.(s): AD-A399430; 153-6702; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report covers the fourth year of progress of the 1997 MURI on RF photonics for Antenna Arrays at the University of Colorado, Montana State University, George Mason University, and the University of California Davis. Novel techniques for optical control and processing of the wideband RF and microwave signals encountered in phased array antennas are being developed, guided by research in spatio-temporal adaptive processing algorithms and active quasioptical RF antenna arrays. The primary goal of this research is to develop enabling optical techniques that provide dramatic improvements in antenna array performance over conventional RF, optical, and digital techniques, allowing the efficient processing of large broadband antenna arrays. Coherent modulation and detection is made robust and practical by the use of dynamic holography in photorefractive and optical coherent transient media. This report summarizes the teams management, educational, and outreach activities, as well as technical progress in the 4th year on the constituent projects broadband adaptive optical array processing, spatio-temporal array processing algorithms, coherent-transient true-time delay, photorefractive signal extraction, optical antenna control, and polymer in-line fiber modulators.

DTIC

*Radio Frequencies; Photonics; Holography; Antenna Arrays; Phased Arrays; Optical Control*

**20020040798** Arizona Univ., Dept. of Electrical and Computer Engineering, Tucson, AZ USA

**Restoration and Super-Resolution of Diffraction-Limited Imagery Data by Bayesian and Set-Theoretic Approaches Final Report, 1 Mar. 2000-31 Oct. 2001**

Sundareshan, Malur K.; Nov. 30, 2001; 59p; In English

Contract(s)/Grant(s): F49620-00-1-0167

Report No.(s): AD-A399674; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This project was primarily aimed at the design of novel algorithms for the restoration and super-resolution processing of imagery data to improve the resolution in images acquired from practical sensing operations. Due to the underlying diffraction limits, the image recorded at the output of the imaging system is usually a low-pass filtered version of the original scene and hence recovery of the lost information contributing to the finer details is required to produce resolution enhancement. Super-resolution algorithms attempt to provide not only passband restoration but also some degree of spectral extrapolation thus enabling to restore the high frequency spatial altitude variations relating to the spatial resolution of the sensor and lost due to diffraction-limited imaging. These algorithms are typically iterative in nature and implement nonlinear signal processing operations. Two distinct approaches that have resulted in powerful super-resolution algorithms are based on statistical optimization arguments and set-theoretic estimation procedures. The principal objectives in this project were to develop and evaluate specific techniques for developing new processing algorithms by combining the strong points of the two approaches. The principal outcomes from this work include the following: (1) Systematic procedures for extracting and modeling scene-derived information sets for projection-based set-theoretic super-resolution processing; and (2) Design of hybrid processing algorithms that integrate Projection Onto Convex Sets (POCS) iterations with Maximum Likelihood (ML) estimation procedures to yield superior restoration and super-resolution performance.

DTIC

*Algorithms; Imaging Techniques; Restoration; Imagery*

36  
**LASERS AND MASERS**

*Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also 76 Solid-State Physics.*

**20020040377** Analytic Sciences Corp., San Antonio, TX USA

**A Preliminary Study of the Application of Probabilistic Risk Assessment Techniques to High-Energy Laser Energy *Final Report***

Smith, Peter; Keppler, Ken; Van Veldhulzen, David; Dec. 2001; 33p; In English

Contract(s)/Grant(s): F41624-97-D-9000; Proj-3257

Report No.(s): AD-A399396; AFRL-HE-BR-TR-2001-0170; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A deterministic approach to laser hazard assessment is used in most laser safety standards. Personnel are protected from hazardous laser radiation by defining a space within which the direct, reflected, or scattered radiation during laser operation exceeds the safe Maximum Permissible Exposure level. Controlling access to this space insures safety. Although this approach has satisfied the commercial and industrial laser communities for many years, it may not be applicable to the high-power (up to megawatt) laser systems currently being developed by the U.S. Military. These systems will have extremely long laser hazard distances, and controlling access to this space will be unrealistic, especially when the likelihood of hazardous human exposure is low. For these situations, an alternate analytical approach that estimates both the level of risk and the degree of risk reduction achievable by controlling key contributors can be applied. Analytic risk assessment tools are finding increasing application in a wide variety of hazard assessments, in both industrial and commercial situations. These tools use scientific data, assumptions, and mathematical models to estimate the likelihood, frequency, and severity of harm to people exposed to the hazard. This report discusses the application of such tools to laser safety and considers the uncertainties associated with probability density functions applied to key factors such as atmospheric scintillation, reflected radiation, population distribution and ocular injury.

DTIC

*Lasers; Laser Damage; Safety*

**20020040378** Directed Energy Solutions, Colorado Springs, CO USA

**Cost Effective, Scalable Optically Pumped Molecular Laser *Final Report, 1 May 2000-28 Jan. 2001***

Nicholson, Jeff; Neumann, David; Rudolph, Wolfgang; Feb. 2001; 31p; In English; Prepared in collaboration with the University of New Mexico, Dept. of Physics and Astronomy, Albuquerque, NM

Contract(s)/Grant(s): F29601-00-C-0095; Proj-3005

Report No.(s): AD-A399395; DES-2001-02; AFRL-DE-TR-2001-1015; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An optically pumped, For laser was demonstrated operating at 4.0 micrometers. This is the first demonstration of an HBr laser by direct optical pumping of the 0 right arrow 3 vibrational overtone band at 1.34 micrometers. An injection locked, temperature tuned Nd: YAG laser was used as the optical pump source. Lasing was achieved in a cell of HBr maintained at 100 Torr. potential for scaling to higher pulse energies has been demonstrated. The HBr laser has potential use as a source for infrared countermeasures.

DTIC

*Laser Pumping; Lasers; Hydrogen; Bromides*

**20020040882** Clark-MXR, Inc., Dexter, MI USA

**Reliable, Intense, Ultrafast and Compact Guided-Wave Laser for Cloud Penetration, Remote Sensing, and Active Imaging *Final Report, 5 Oct. 1999-3 Oct 2000***

Bado, Philippe; Sep. 2000; 46p; In English

Contract(s)/Grant(s): F29601-99-C-0044; AF Proj. 3005

Report No.(s): AD-A399469; MXR0010; AFRL-DE-TR-2000-1079; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this program is to develop reliable, ultrafast, high peak-power lasers. These lasers will be used in the military for cloud penetration, reconnaissance, remote sensing, and active illumination; in the microelectronic industry for repair of photomasks and for memory yield improvement; in the automotive industry for sensors and fuel injector machining; and in the aerospace industry for turbine blade machining. We met all of our Phase I objectives. We built a fiber based front-end delivering peak power in excess of 10 MW. We demonstrated the direct write of large core waveguides. We fabricated active waveguides

by direct write. We demonstrated a new non-linear Raman-Soliton compression technique. Combining these various results, we are confident that we will be able to deliver fiber lasers capable of delivering peak power in the gigawatt and ultimately the terawatt range.

DTIC

*Fiber Lasers; Fiber Optics; High Power Lasers*

## 37

### MECHANICAL ENGINEERING

*Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see 63 Cybernetics, Artificial Intelligence, and Robotics; and 54 Man/System Technology and Life Support.*

**20020039318** Department of the Navy, Washington, DC USA

#### **Tether Retraction Device**

Williams, Michael R., Inventor; Bergeron, Michael A., Inventor; Cipolla, Kimberly M., Inventor; Jul. 30, 2001; 18p; In English Patent Info.: Filed 30 Jul. 2001; US-Patent-Appl-SN-09922312

Report No.(s): AD-D019993; No Copyright; Avail: Defense Technical Information Center (DTIC)

The present invention relates to a tether retraction device having particular utility with multi-line towed arrays. A system for retrieving and deploying a multi-line towed array having a plurality of array lines has at least one tether joinable between two of the plurality of array lines. A tether retraction device is incorporated into at least one of the array lines for retracting the tether. Each tether retraction device has a tether take-up spool, and a spring driven drive means which causes the tether to wind onto the take-up spool when the array is towed at slow speeds and allows deployment of the tether from the take-up spool when tension in the tether caused by tow forces exceeds the spring force applied by the spring driven drive means.

DTIC

*Patent Applications; Tethering; Towed Bodies; Reels*

**20020039704** NASA Kennedy Space Center, Cocoa Beach, FL USA

#### **Designing Crane Controls with applied Mechanical and Electrical Safety Features**

Lytle, Bradford P., NASA Kennedy Space Center, USA; Walczak, Thomas A., Walczak (Thomas A.), USA; [2002]; 14p; In English; 5th Symposium on PLC In Safety Related Applications, 7-8 May 2002, Cologne, Germany; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The use of overhead traveling bridge cranes in many varied applications is common practice. In particular, the use of cranes in the nuclear, military, commercial, aerospace, and other industries can involve safety critical situations. Considerations for Human Injury or Casualty, Loss of Assets, Endangering the Environment, or Economic Reduction must be addressed. Traditionally, in order to achieve additional safety in these applications, mechanical systems have been augmented with a variety of devices. These devices assure that a mechanical component failure shall reduce the risk of a catastrophic loss of the correct and/or safe load carrying capability. ASME NOG-1-1998, (Rules for Construction of Overhead and Gantry Cranes, Top Running Bridge, and Multiple Girder), provides design standards for cranes in safety critical areas. Over and above the minimum safety requirements of todays design standards, users struggle with obtaining a higher degree of reliability through more precise functional specifications while attempting to provide "smart" safety systems. Electrical control systems also may be equipped with protective devices similar to the mechanical design features. Demands for improvement of the cranes "control system" is often recognized, but difficult to quantify for this traditionally "mechanically" oriented market. Finite details for each operation must be examined and understood. As an example, load drift (or small motions) at close tolerances can be unacceptable (and considered critical). To meet these high functional demands encoders and other devices are independently added to control systems to provide motion and velocity feedback to the control drive. This paper will examine the implementation of Programmable Electronic Systems (PES). PES is a term this paper will use to describe any control system utilizing any programmable electronic device such as Programmable Logic Controllers (PLC), or an Adjustable Frequency Drive (AID) 'smart' programmable motion controller. Therefore the use of the term Programmable Electronic Systems (PES) is an encompassing description for a large spectrum of programmable electronic control devices.

Author

*Cranes; Mechanical Engineering; Electronic Control; Control Systems Design; Safety*

## QUALITY ASSURANCE AND RELIABILITY

*Includes approaches to, and methods for reliability analysis and control, inspection, maintainability, and standardization.*

**20020039140** NASA Langley Research Center, Hampton, VA USA

### **An Approach to Risk-Based Design Incorporating Damage Tolerance Analyses**

Knight, Norman F., Jr., Veridian Systems Div., USA; Glaessgen, Edward H., NASA Langley Research Center, USA; Sleight, David W., NASA Langley Research Center, USA; [2002]; 24p; In English; 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 22-25 Apr. 2002, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-1267; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Incorporating risk-based design as an integral part of spacecraft development is becoming more and more common. Assessment of uncertainties associated with design parameters and environmental aspects such as loading provides increased knowledge of the design and its performance. Results of such studies can contribute to mitigating risk through a system-level assessment. Understanding the risk of an event occurring, the probability of its occurrence, and the consequences of its occurrence can lead to robust, reliable designs. This paper describes an approach to risk-based structural design incorporating damage-tolerance analysis. The application of this approach to a candidate Earth-entry vehicle is described. The emphasis of the paper is on describing an approach for establishing damage-tolerant structural response inputs to a system-level probabilistic risk assessment.

Author

*Design Analysis; Risk; Structural Design; Tolerances (Mechanics)*

## STRUCTURAL MECHANICS

*Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.*

**20020039139** NASA Glenn Research Center, Cleveland, OH USA

### **Fidelity of the Integrated Force Method Solution**

Hopkins, Dale, NASA Glenn Research Center, USA; Halford, Gary, NASA Glenn Research Center, USA; Coroneos, Rula, NASA Glenn Research Center, USA; Patnaik, Surya, Ohio Aerospace Inst., USA; January 2002; 34p; In English

Contract(s)/Grant(s): RTOP 910-30-11

Report No.(s): NASA/TM-2002-211286; E-13087; NAS 1.15:211286; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The theory of strain compatibility of the solid mechanics discipline was incomplete since St. Venant's 'strain formulation' in 1876. We have addressed the compatibility condition both in the continuum and the discrete system. This has led to the formulation of the Integrated Force Method. A dual Integrated Force Method with displacement as the primal variable has also been formulated. A modest finite element code (IFM/Analyzers) based on the IFM theory has been developed. For a set of standard test problems the IFM results were compared with the stiffness method solutions and the MSC/Nastran code. For the problems IFM outperformed the existing methods. Superior IFM performance is attributed to simultaneous compliance of equilibrium equation and compatibility condition. MSC/Nastran organization expressed reluctance to accept the high fidelity IFM solutions. This report discusses the solutions to the examples. No inaccuracy was detected in the IFM solutions. A stiffness method code with a small programming effort can be improved to reap the many IFM benefits when implemented with the IFMD elements. Dr. Halford conducted a peer-review on the Integrated Force Method. Reviewers' response is included.

Author

*Solid Mechanics; Continuum Mechanics; Numerical Integration; Compatibility; Structural Analysis; Strain Distribution*

**20020039166** NASA Johnson Space Center, Houston, TX USA

### **Reentry Vehicle Flight Controls Design Guidelines: Dynamic Inversion**

Ito, Daigoro, NASA Johnson Space Center, USA; Georgie, Jennifer, Texas A&M Univ., USA; Valasek, John, Texas A&M Univ., USA; Ward, Donald T., NASA Johnson Space Center, USA; March 2002; 114p; In English

Report No.(s): NASA/TP-2002-210771; S-881; NAS 1.60:210771; No Copyright; Avail: CASI; A06, Hardcopy; A02,

## Microfiche

This report addresses issues in developing a flight control design for vehicles operating across a broad flight regime and with highly nonlinear physical descriptions of motion. Specifically it addresses the need for reentry vehicles that could operate through reentry from space to controlled touchdown on Earth. The latter part of controlled descent is achieved by parachute or paraglider - or by all automatic or a human-controlled landing similar to that of the Orbiter. Since this report addresses the specific needs of human-carrying (not necessarily piloted) reentry vehicles, it deals with highly nonlinear equations of motion, and then-generated control systems must be robust across a very wide range of physics. Thus, this report deals almost exclusively with some form of dynamic inversion (DI). Two vital aspects of control theory - noninteracting control laws and the transformation of nonlinear systems into equivalent linear systems - are embodied in DI. Though there is no doubt that the mathematical tools and underlying theory are widely available, there are open issues as to the practicality of using DI as the only or primary design approach for reentry vehicles. This report provides a set of guidelines that can be used to determine the practical usefulness of the technique.

Author

*Flight Control; Reentry Vehicles; Aerospace Engineering; Spacecraft Control; Control Systems Design*

**20020039288** Institute TNO of Applied Physics, Delft, Netherlands

### **Structural Dynamic and Radiation Characteristics of Cross-Stiffened Plates**

Petersson, B. A. T., Institut fuer Technische Akustik, Germany; Oct. 04, 2001; 23p; In English

Contract(s)/Grant(s): A00/KM/137; TNO Proj. 008.02706/01.01

Report No.(s): TD-010085; HAG-RPT-010081; Copyright; Avail: Issuing Activity

A theoretical and numerical analysis is undertaken of the structural dynamic and radiation characteristics of cross-stiffened plates. The structure is subject to a force excitation at the stiffener crossing. The plate and stiffening beams are assumed thin and slender respectively, such that Kirchhoff and Euler-Bernoulli theories are applicable. Moreover, the numerical analysis is confined to structural configurations where the material properties are the same for all constituents. of primary concern is the effect of adding a second beam, orthogonally to the primary. It is found that the mobility is further reduced by adding the orthogonal beam. The supplementary reduction in mobility, however, is additive such that for equal stiffeners in the two directions, the mobility becomes half that of the single stiffened plate. For different stiffeners, the mobility, thence, is essentially controlled by the stiffest member. With respect to radiation, two features counteract each other. Owing to the decreased mobility, the radiation is reduced but the improved structural-fluid coupling, following from the, now increased wavelength in two orthogonal directions, limits the reduction.

Author

*Dynamic Structural Analysis; Mobility; Numerical Analysis; Radiation Measurement*

**20020039841** Building and Construction Research TNO, Centre for Maritime Engineering, Delft, Netherlands

### **Design Aspects in Single Lap Bonded Joints Focused on Mechanical Stresses and Strength Final Report**

Fey, R. H. B., Building and Construction Research TNO, Netherlands; Nov. 30, 2001; 183p; In English; Original contains color illustrations

Contract(s)/Grant(s): A00/KM/134; TNO Proj. 006.13687/01.01

Report No.(s): TD-2001-017; Rept-2001-CMC-R031; Copyright; Avail: Issuing Activity

In this report design aspects of adhesively bonded joints will be investigated. They can be applied in the superstructure of naval vessels where (dis)similar materials such as composites, steel, and aluminium need to be joined. The single lap joint is taken as base geometry. Important design parameters are identified and the influence of some of these parameters on the adhesive and adherend stresses and the joint strength are investigated using analytical and finite element analyses. Investigated design parameters are the overlap length, the adherend thickness, the adhesive thickness, and the type of adhesive. Several possibilities to improve the joint strength by modifying the local geometry of the overlap ends are given, e.g., adhesive fillet tapering and reverse tapering of the adherend. A yield criterion describing plastic behaviour of ductile adhesives is discussed; this criterion depends on the hydro-static stress, in addition attention is paid to strain rate dependent behaviour of adhesives and bonded joints. In the design process of bonded joints, analytical methods, finite element methods, and experimental methods each have their merits. Two analytical methods have been implemented in a spreadsheet and can be used in the initial stage of the design process. Once the global dimensions of the joint are approximately known, an experimental/numerical approach needs to be followed in order to account for stress singularities in the finite element approach.

Author

*Adhesive Bonding; Adhesives; Lap Joints; Mechanical Properties; Bonded Joints; Stress Analysis*

**20020040347** Defence Science and Technology Organisation, Airframes and Engines Div., Fishermans Bend, Australia

**Determining Beam Bending Distribution Using Dynamic Information**

Polanco, Frank G., Defence Science and Technology Organisation, Australia; January 2002; 48p; In English  
Report No.(s): DSTO-RR-0226; DODA-AR-012097; Copyright; Avail: Issuing Activity

As a first approximation, a helicopter rotor blade may be modelled as a cantilever beam. Given the initial deformation of this beam, and using either strain or acceleration at one location along the beam, we can determine the load distribution along the entire beam. We consider load distributions that can vary spatially, but are constant in time (except for the initial step input). In the solution we neglect the effects of both aerodynamic and mechanical damping. The separation of variables technique leads to a solution in terms of the beam's natural modes. The loading distribution is decomposed in terms of these modes. A finite element simulation of the beam's response to a cubic load distribution verifies that this load prediction is possible. We demonstrate that the higher modes of the load prediction are unstable when noise is present in the measurements, but that the lower modes are robust. If the initial beam deformation is unknown, then additional (strain or vibration) measurement locations may be substituted for the unknown initial deformation.

Author

*Bending; Cantilever Beams; Deformation; Rotary Wings*

## 42

### GEOSCIENCES (GENERAL)

*Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see categories 41 through 48.*

**20020040782** Oak Ridge National Lab., TN USA

**Carbon Sequestration in Terrestrial Ecosystems: A Status Report on R and D Progress**

Jacobs, G. K., Oak Ridge National Lab., USA; Aug. 30, 2001; 8p; In English  
Report No.(s): DE2002-788722; P01-111559; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Sequestration of carbon in terrestrial ecosystems is a low-cost option that may be available in the near-term to mitigate increasing atmospheric CO<sub>2</sub> concentrations, while providing additional benefits. Storing carbon in terrestrial ecosystems can be achieved through maintenance of standing aboveground biomass, utilization of aboveground biomass in long-lived products, or protection of carbon (organic and inorganic) compounds present in soils. There are potential co-benefits from efforts to sequester carbon in terrestrial ecosystems. For example, long-lived valuable products (wood) are produced, erosion would be reduced, soil productivity could be improved through increased capacity to retain water and nutrients, and marginal lands could be improved and riparian ecosystems restored. Another unique feature of the terrestrial sequestration option is that it is the only option that is 'reversible' should it become desirable or permissible. For example, forests that are created are thus investments which could be harvested should CO<sub>2</sub> emissions be reduced in other ways to acceptable levels 50-100 years from now.

NTIS

*Biomass; Ecosystems; Forests; Terrestrial Radiation; Carbon Dioxide Concentration*

## 43

### EARTH RESOURCES AND REMOTE SENSING

*Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis or remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photographs. For instrumentation see 35 Instrumentation and Photography.*

**20020039750** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Comparative Analysis of Daytime Fire Detection Algorithms, Using AVHRR Data for the 1995 Fire Season in Canada: Perspective for MODIS**

Ichoku, Charles, Science Systems and Applications, Inc., USA; Kaufman, Y. J., NASA Goddard Space Flight Center, USA; Fraser, R. H., Canada Centre for Remote Sensing, Canada; Jin, J.-Z., Canada Centre for Remote Sensing, Canada; Park, W. M., Canada Centre for Remote Sensing, Canada; [2001]; 39p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two fixed-threshold Canada Centre for Remote Sensing and European Space Agency (CCRS and ESA) and three contextual GIGLIO, International Geosphere and Biosphere Project, and Moderate Resolution Imaging Spectroradiometer (GIGLIO, IGBP,

and MODIS) algorithms were used for fire detection with Advanced Very High Resolution Radiometer (AVHRR) data acquired over Canada during the 1995 fire season. The CCRS algorithm was developed for the boreal ecosystem, while the other four are for global application. The MODIS algorithm, although developed specifically for use with the MODIS sensor data, was applied to AVHRR in this study for comparative purposes. Fire detection accuracy assessment for the algorithms was based on comparisons with available 1995 burned area ground survey maps covering five Canadian provinces. Overall accuracy estimations in terms of omission (CCRS=46%, ESA=81%, GIGLIO=75%, IGBP=51%, MODIS=81%) and commission (CCRS=0.35%, ESA=0.08%, GIGLIO=0.56%, IGBP=0.75%, MODIS=0.08%) errors over forested areas revealed large differences in performance between the algorithms, with no relevance to type (fixed-threshold or contextual). CCRS performed best in detecting real forest fires, with the least omission error, while ESA and MODIS produced the highest omission error, probably because of their relatively high threshold values designed for global application. The commission error values appear small because the area of pixels falsely identified by each algorithm was expressed as a ratio of the vast unburned forest area. More detailed study shows that most commission errors in all the algorithms were incurred in nonforest agricultural areas, especially on days with very high surface temperatures. The advantage of the high thresholds in ESA and MODIS was that they incurred the least commission errors.

Author

*Advanced Very High Resolution Radiometer; Algorithms; Canada; Detection; Spectroradiometers; Forest Fires; Remote Sensing*

**20020040115** Washington Univ., Applied Physics Lab., Seattle, WA USA

**Airborne Microwave Imaging of River Velocities Final Report, 1 Aug. 1998 - 31 Dec. 2001**

Plant, William J., Washington Univ., USA; Mar. 25, 2002; 22p; In English; CD-ROM contains full text document in PDF format  
Contract(s)/Grant(s): NAG5-7550

Report No.(s): NONP-NASA-CD-2002065409; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this project was to determine whether airborne microwave remote sensing systems can measure river surface currents with sufficient accuracy to make them prospective instruments with which to monitor river flow from space. The approach was to fly a coherent airborne microwave Doppler radar, developed by APL/UW, on a light airplane along several rivers in western Washington state over an extended period of time. The fundamental quantity obtained by this system to measure river currents is the mean offset of the Doppler spectrum. Since this scatter can be obtained from interferometric synthetic aperture radars (INSARs), which can be flown in space, this project provided a cost effective means for determining the suitability of spaceborne INSAR for measuring river flow.

Author

*Microwave Imagery; Rivers; Water Flow; Remote Sensing; Data Processing*

**20020040400** Corps of Engineers, Engineer Research and Development Center, Vicksburg, MS USA

**Image Data Acquisition System User's Guide and Technical Documentation Final Report**

Hahn, Charles D.; Ballard, Jerrell R., Jr.; Sep. 2001; 47p; In English; Original contains color images

Report No.(s): AD-A399452; ERDC/EL-TR-01-27; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Image data collection activities are typically limited to the use of normal aerial photography techniques. This approach is often expensive and requires extensive ground control. The imagery is limited in the ability to "see" the sides of features or underneath the tree canopy. The Image Data Acquisition System (IDAS) provides a low-cost alternative to traditional aerial photography. IDAS couples inexpensive video technology with Global Positioning Satellite (GPS) technology to provide referenced video imagery in real time with minimal requirements for ground control and rigid flight plans. Additional sensors (digital compass, gyroscope, and altimeter) provide camera geometry regardless of the platform path. IDAS is a portable system that can be easily deployed on multiple platforms (aircraft, boats, or ground vehicles). The data processing system couples the imagery, position, and camera geometry data with a terrain database to provide approximate ground locations for features imaged.

DTIC

*Data Processing; Data Acquisition; Aerial Photography; Ground Based Control; Data Processing Equipment*

**20020040407** Corps of Engineers, Engineer Research and Development Center, Champaign, IL USA

**A Catalog of Applications for Classified and Declassified Satellite Imagery Final Report**

Lozar, Robert; Smith, Wade; Adeyemi, Hazeklah; Taylor, Olaylwola; Jacokes, Renee; Aug. 2001; 138p; In English; Original contains color images

Report No.(s): AD-A399458; ERDC/CERL-TR-01-61; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The U.S. is making available both formerly and currently classified satellite imagery to support environmental evaluation. Military land managers expressed interest in using these materials. The technological and staff resources to integrate the imagery

into regular land management activities exist at the installations. Installation staff indicated that their greatest need was workbook examples of how this material could be applied to their land management activities. This catalog provides illustrative examples. The applications were chosen based on expressed installation needs. The most commonly requested application examples are also those that can be the easiest to carry out and provide the greatest cost savings. Access to secure resources on the installation and need for clearances are not requirements for using the analyses illustrated. Application areas described in this report include: ecosystem change habitat change urban and land use change road construction analysis visualization techniques discovery of former training ranges vegetation trend analysis in support of regional management forestry management fire burn recovery discovery of old disposal sites extending climate change trend analysis baselines Base Realignment and Closure (BRAC) support wetland change invasive species cultural resources examination sea-weed distribution and determination of pre-deployment environmental baseline conditions overseas.

DTIC

*Digital Systems; Satellite Imagery; Land Management; Climate Change; Training Analysis*

**20020040768** California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

**Higher-order differencing for phase-front propagation in geothermal systems**

Oldenburg, C.; Pruess, K.; Jan. 09, 1998; 8p; In English

Report No.(s): DE2002-789975; LBNL--41268; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We are testing higher-order differencing total variation diminishing schemes implemented in the reservoir simulator TOUGH2 to reduce numerical dispersion of phase fronts in geothermal flow problems. The schemes are called total variation diminishing because they employ flux limiters to prevent spurious oscillations that sometimes occur with other higher-order differencing schemes near sharp fronts. Thus it appears that total variation diminishing schemes rely on an implicit assumption that the overall variability of advected quantities stays constant or diminishes with time. We use the Leonard total variation diminishing scheme in two special problems designed to test the applicability of the scheme for cases where this implicit assumption is violated. In the first problem, we investigate the isothermal propagation of a phase front in a composite porous medium where phase saturation increases as the front enters the second medium. In the second problem, we investigate the propagation of a phase front where boiling increases the saturation difference across the front as it propagates. In the composite porous medium problem, we find that spurious phase saturations can arise if the weighting scheme is based on relative permeability; for weighting based on phase saturation, no such oscillation arises. In the boiling front propagation problem, the front position is highly sensitive to weighting scheme, and the Leonard total variation diminishing scheme is more accurate than upstream weighting because it decreases numerical dispersion in the thermal energy equation.

NTIS

*Finite Difference Theory; Reservoirs; Geothermal Technology; TVD Schemes; Phase Transformations*

## 44

### ENERGY PRODUCTION AND CONVERSION

*Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.*

**20020039910** Center for Army Analysis, Fort Belvoir, VA USA

**AESOP Final Report, Aug. 1999-Mar. 2001**

Keller, James, Jr; Mar. 2000; 41p; In English

Report No.(s): AD-A399197; CAA-R-01-15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Army is currently a party to scores of Energy Savings Performance Contracts (ESPCs). Under these ESPCs, contractors implement energy saving technology at Army facilities in return for a share of the annual dollar savings stream that the technology creates. Collectively, these ESPCs form the Army's Energy Saving Outsourcing Portfolio. In this analysis, Center for Army Analysis: (a) determines if ESPC buyouts are economically attractive, (b) estimates finding level(s) needed for ESPC buyouts, and (c) compares the economic attractiveness of buying out ESPCs to that of investing in other energy saving opportunities.

DTIC

*Contract Management; Cost Analysis; Energy Conservation*

**20020040113** Naval Postgraduate School, Dept. of Electrical and Computer Engineering, Monterey, CA USA

**The Control of Parallel-Connected Inverters for U.S. Navy Shipboard Applications**

Ciezki, John G.; Ashton, Robert W.; Apr. 18, 2001; 44p; In English

Report No.(s): AD-A399297; NPS-EC-01-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Concepts such as the Integrated Power System (IFS) and the DC Zonal Electric Distribution System (DC ZEDS) have motivated the study of power inverter control and paralleling strategies by the U.S. Navy. For example, in DC ZEDS a Ship Service Inverter Module (SSIM) converts DC power into AC power for use within a zone. For reasons of redundancy and logistics, multiple paralleled inverter submodules are used to implement the SSIM. The current effort supports ongoing SSIM hardware development by the SatCon Corporation. This report documents the modeling and control analysis of a set of parallel-connected PWM inverters. Although initially focusing on a static three-phase R-L load, the analysis is extended to three-phase symmetrical induction machine loads and three-phase round-rotor permanent-magnet synchronous machine loads. In each case, an algorithm for designing the local inner current control is developed by employing reference frame theory, replacing the paralleled inverters by an equivalent unit, and executing a nonlinear pole-placement strategy. Upon reviewing the equations necessary for AC machine vector control, the report concludes by documenting the analysis and design of a simple speed control loop for this aforementioned machine loads.

DTIC

*Inverters; Pulse Modulation; Directional Control; Service Modules*

**20020040402** Barber-Nichols Engineering Co., Arvada, CO USA

**Oxygen Source for Underwater Vehicle Fuel Cells Final Report, 27 Jul. 2001-4 Mar. 2002**

Batton, William E.; Hotton, Kevin D.; Peters, Jonathan A.; Klanchar, Martin; Mar. 04, 2002; 35p; In English

Contract(s)/Grant(s): N00014-01-M-0210

Report No.(s): AD-A399463; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Four successful tests were conducted to demonstrate the usefulness of lithium oxide as a catalyst and manganese as a fuel for the release of oxygen by the decomposition of lithium perchlorate at low temperature. The test apparatus included two stainless vessels, one to hold molten lithium perchlorate and the other the reaction vessel. The molten perchlorate was fed to the reaction vessel using dry nitrogen gas as a driver. Two tests were conducted using lithium oxide as a catalyst with the reaction chamber at 1,000 deg F. Both tests produced oxygen immediately upon introduction of 600 deg F lithium perchlorate. These tests lasted for eight and thirteen minutes. Two additional tests were conducted using a mixture of manganese and lithium oxide in the reaction vessel at 600 deg F. In both cases there was an immediate, significant temperature increase indicating oxidation of the manganese. The feed nozzle plugged during both manganese tests, most likely due to lithium perchlorate decomposition in the nozzle due to high temperature. The report includes a go forward plan for additional quantifying tests.

DTIC

*Oxygen; Fuel Cells; Lithium Perchlorates; Manganese Oxides; Underwater Vehicles*

**20020040565** Center for Army Analysis, Fort Belvoir, VA USA

**ADAPT Final Report, Jan. 1999-Jul. 2000**

Jones, Hugh W.; Mitchell, Kent R., Jr; Jul. 2000; 58p; In English

Report No.(s): AD-A399184; CAA-R-00-3; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

ADAPT examines photovoltaics (PV) in both a military operations context and within a cost/benefit analysis framework. Both of these topics are now in the forefront of transforming the Army into a strategically responsive force that is dominant across the full spectrum of operations. This report illustrates that PV, as a renewable energy alternative to fossil fuels, has potential in both current and future Army deployments.

DTIC

*Military Operations; Photovoltaic Conversion; Renewable Energy*

**20020040772** Pacific Northwest National Lab., Richland, WA USA

**High Temperature Ceramic Fuel Cell Measurement and Diagnostics for Application to Solid Oxide Fuel Cell Systems**

Koehler, T. M.; Jarrell, D. B.; Bond, L. J.; Oct. 29, 2001; 60p; In english

Report No.(s): DE2002-789924; PNNL-13716; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper is the result of an extensive literature review and technology evaluation, performed to determine the status of sensors and measurement technologies.

NTIS

*Solid Oxide Fuel Cells; Ceramics; High Temperature*

**20020040820** National Renewable Energy Lab., Golden, CO USA

**Electrical Currents and Adhesion of Edge-Delete Regions of EVA-to-Glass Module Packaging: Preprint**

McMahon, T. J.; Jorgensen, G. J.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000001; NREL/CP-520-30819; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Electrical conductivity pathways from the grounded frame to the cell area in a PV module are reviewed here.

NTIS

*Electrical Resistivity; Photovoltaic Cells; Adhesion*

**20020040821** National Renewable Energy Lab., Golden, CO USA

**Measurements of Backsheet Moisture Permeation and Encapsulant-Substrate Adhesion: Preprint**

Jorgensen, G.; Terwilliger, K.; Barber, G.; Kennedy, C.; McMahon, T.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000000; NREL/CP-520-30818; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Measurements of backsheet moisture permeation and encapsulant-substrate adhesion.

NTIS

*Photovoltaic Cells; Moisture; Permeating; Substrates*

**20020040822** National Renewable Energy Lab., Golden, CO USA

**Radiometric Calibrations, Measurements, and Standards Development at NREL: Preprint**

Myers, D. R.; Andreas, A.; Stoffel, T.; Reda, I.; Wilcox, S.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000008; NREL/CP-560-30964; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Radiometric calibrations, measurements, and standards development at NREL.

NTIS

*Photovoltaic Cells; Radiometers*

**20020040823** National Renewable Energy Lab., Golden, CO USA

**Pvwatts version 2 -- enhanced spatial resolution for calculating grid-connected pv performance: preprint**

Marion, B.; Anderberg, M.; Gray-Hann, P.; Heimiller, D.; George, R.; Oct. 01, 2001; 6p; In English

Report No.(s): DE2002-15000006; NREL/CP-560-30941; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Describes the latest version of PVWATTS and how its spatial resolution was improved by a factor of 25.

NTIS

*Photovoltaic Cells; Spatial Resolution*

**20020040824** National Renewable Energy Lab., Golden, CO USA

**DOE Fundamental and Exploratory Research Program in Photovoltaics: Preprint**

Matson, R.; McConnell, R.; Eddy, F. P.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000005; NREL/CP-520-30873; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Overview of the Fundamental and Exploratory Research project with the DOE Basic Sciences program and the National Center for Photovoltaics.

NTIS

*Photovoltaic Cells; Experimentation; Photovoltaic Conversion*

**20020040825** National Renewable Energy Lab., Golden, CO USA

**Performance Degradation of Encapsulated Monocrystalline-Si Solar Cells upon Accelerated Weathering Exposures: Preprint**

Glick, S. H.; Pern, F. J.; Watson, G. L.; Tomek, D.; Raaff, J.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000004; NREL/CP-520-30841; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at 2001 NCPV Program Review Meeting: Performed accelerated exposures to study performance reliability/materials degradation of encapsulated c-Si cells using weathering protocols in 2 weatherometers.

NTIS

*Solar Cells; Single Crystals; Exposure*

**20020040826** National Renewable Energy Lab., Golden, CO USA

**High-Quality 10 /s Amorphous Silicon Germanium Alloy Solar Cells by Hot-Wire CVD: Preprint**

Wang, Q.; Iwaniczko, E.; Wang, J.; Lord, K.; Guha, S.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000003; NREL/CP-520-30823; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: High-quality high-deposition-rate (10 angstrom/s) a-SiGe:H alloy solar cells have been made by hot-wire chemical-vapor deposition.

NTIS

*Vapor Deposition; Solar Cells; Amorphous Silicon; Silicon Alloys*

**20020040827** National Renewable Energy Lab., Golden, CO USA

**Energy Production and Performance of Polycrystalline Silicon Technology Photovoltaic Modules in the Field: Preprint**

del Cueto, J. A.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000002; NREL/CP-520-30822; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Energy production and performance of polycrystalline silicon technology photovoltaic modules in the field.

NTIS

*Photovoltaic Cells; Polycrystals; Silicon*

**20020040828** National Renewable Energy Lab., Golden, CO USA

**Real-Time and Accelerated Solar Weathering of Commercial PV Modules: Preprint**

Osterwald, C. R.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000023; NREL/CP-520-30992; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: We report the observed degradation in 6 different types of PV modules as a function of total UV exposure and give a number of recommendations for future weathering tests.

NTIS

*Photovoltaic Cells; Weathering; Solar Atmosphere*

**20020040829** National Renewable Energy Lab., Golden, CO USA

**Epitaxial Growth of BGaAs and BGaInAs by MOCVD: Preprint**

Geisz, J. F.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000022; NREL/CP-520-31014; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Comparison of use of TMB, TEB, and BF<sub>3</sub> to diborane for MOCVD growth of BGaInAs.

NTIS

*Solar Cells; Metalorganic Chemical Vapor Deposition; Epitaxy*

**20020040835** National Renewable Energy Lab., Golden, CO USA

**Analysis of Nitrogen Incorporation in Group III-Nitride-Arsenide Materials Using a Magnetic Sector Secondary-Ion Mass Spectrometry (SIMS) Instrument: Preprint**

Reedy, R. C.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000027; NREL/CP-520-31005; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Group III-nitride-arsenide materials were studied by SIMS, XRD, and Profiler to determine small amounts of nitrogen that can lower the alloys bandgap significantly.

NTIS

*Nitrogen; Solar Cells; Secondary Ion Mass Spectrometry; Energy Gaps (Solid State)*

**20020040836** National Renewable Energy Lab., Golden, CO USA

**High-Resolution AES Mapping and TEM Study of Cu(In,Ga)Se<sub>2</sub> Thin Film Growth: Preprint**

Perkins, C. L.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000026; NREL/CP-520-31004; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at 2001 NCPV Program Review Meeting: TEM and high-resolution AES mapping data on CIGS samples.

NTIS

*Electron Spectroscopy; Thin Films; Auger Spectroscopy*

**20020040851** National Renewable Energy Lab., Golden, CO USA

**Performance Summary for the First Solar CdTe 1-kW System: Preprint**

Marion, B.; del Cueto, J.; McNutt, P.; Rose, D.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000007; NREL/CP-520-30942; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Describes performance of 1-kWac CdTe PV array from First Solar operated at NREL from 6/95 to 14/00.

NTIS

*Photovoltaic Cells; Cadmium Tellurides; Solar Cells*

**20020040869** Army Mobility Equipment Research and Development Command, Fort Belvoir, VA USA

**Permanent Magnet Generators for Portable Military Power**

Hammond, E. F., Jr.; King, A. E.; Jokl, A. L.; Jun. 11, 1971; 10p; In English; Presented at mid-year meeting of Society of Automotive Engineering, Montreal, Canada, 7-11 Jun. 1971. Prepared in cooperation with Westinghouse Electric Corp

Contract(s)/Grant(s): DAAK02-69-C-0763

Report No.(s): AD-A399590; 710565; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The USA Army MERDC has a continuing program to develop and update a family of portable and/or mobile power generation sets for use by the USA military services. In the past decade, a number of new permanent magnet materials have been developed, far exceeding the energy products of earlier materials. Recognizing the potential of these new materials, and looking toward a new family of light-weight power generation sets, a feasibility study and preliminary design were completed for a 100 kW, 60,000 rpm rotating field permanent magnet generator.

DTIC

*Permanent Magnets; Electric Generators; Portable Equipment; Military Technology*

**20020040891** National Renewable Energy Lab., Golden, CO USA

**H-Diffusion Mechanism(s) in PECVD Nitride Passivation of Si Solar Cells: Preprint**

Sopori, B.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000024; NREL/CP-520-31002; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Modeled diffusion of H in 2-step Si<sub>3</sub>N<sub>4</sub> passivation process invoking concept of storage of H. H stored during nitridation is redistributed during subsequent anneal.

NTIS

*Hydrogen; Diffusion; Solar Cells; Silicon*

45  
**ENVIRONMENT POLLUTION**

*Includes atmospheric, water, soil, noise, and thermal pollution.*

**20020039168** NASA Marshall Space Flight Center, Huntsville, AL USA

**Variability and Predictability of Land-Atmosphere Interactions: Observational and Modeling Studies** *Final Report, 1 Jun. 1998 - 30 Apr. 2002*

Roads, John, Scripps Institution of Oceanography, USA; Oglesby, Robert, Purdue Univ., USA; Marshall, Susan, North Carolina Univ., USA; Robertson, Franklin R., NASA Marshall Space Flight Center, USA; [2002]; 11p; In English

Contract(s)/Grant(s): NAG8-1516; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overall goal of this project is to increase our understanding of seasonal to interannual variability and predictability of atmosphere-land interactions. The project objectives are to: 1. Document the low frequency variability in land surface features and associated water and energy cycles from general circulation models (GCMs), observations and reanalysis products. 2. Determine what relatively wet and dry years have in common on a region-by-region basis and then examine the physical mechanisms that may account for a significant portion of the variability. 3. Develop GCM experiments to examine the hypothesis that better knowledge of the land surface enhances long range predictability. This investigation is aimed at evaluating and predicting seasonal to interannual variability for selected regions emphasizing the role of land-atmosphere interactions. of particular interest are the relationships between large, regional and local scales and how they interact to account for seasonal and interannual variability, including extreme events such as droughts and floods. North and South America, including the Global Energy and Water Cycle Experiment Continental International Project (GEWEX GCIP), MacKenzie, and LBA basins, are currently being emphasized. We plan to ultimately generalize and synthesize to other land regions across the globe, especially those pertinent to other GEWEX projects.

Derived from text

*Air Land Interactions; Predictions; Annual Variations; Atmospheric General Circulation Models; Hydrology Models*

**20020039335** Colorado State Univ., Dept. of Atmospheric Science, Fort Collins, CO USA

**Modeled Aerosol Optical Properties From Measurement-Based Mixtures of Chemical Species: Assessing the Impacts of Particle Morphology and Absorption** *Final Report, 1 Nov. 1998 - 31 Dec. 2001*

Kreidenweis, Sonia, Colorado State Univ., USA; [2002]; 3p; In English

Contract(s)/Grant(s): NAG5-7783; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report serves as the final report for the Colorado State University portion of this grant. The original grant was awarded to CSU under the direction of co-Principal Investigators Kirk Fuller and Sonia Kreidenweis. Upon Dr. Fuller's relocation to the University of Alabama - Huntsville, the major portion of the award was also relocated. The following summarizes only that work completed by Prof. Kreidenweis under her remaining award.

Derived from text

*Aerosols; Optical Properties; Absorption; Particles*

**20020039336** Alabama Univ., Earth System Science Center, Huntsville, AL USA

**Global Change Research Related in the Earth's Energy and Hydrologic Cycle** *Final Report, 30 Sep. 1997 - 29 Sep. 2000*

Berry, Linda R., Alabama Univ., USA; [2002]; 100p; In English

Contract(s)/Grant(s): NCC8-141; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The mission of the Global Change Research Related to the Earth's Energy and Hydrologic Cycle is to enhance the scientific knowledge and educational benefits obtained from NASA's Earth Science Enterprise and the U.S. Global Change Research Program, University of Alabama in Huntsville (UAH). This paper presents the final technical report on this collaborative effort. Various appendices include: A) Staff Travel Activities years one through three; B) Publications and Presentations years one through three; C) Education Activities; D) Students year one through three; E) Seminars year one through three; and F) Center for Applied Optics Projects.

CASI

*Earth Sciences; Hydrological Cycle; NASA Programs; Research and Development; Climate Change; Education*

**20020039614** Thermoscience Inst., Moffett Field, CA USA

**Theoretical Studies of Some HEDM Species: Cyclic O4, Cyclic O3 and Cubane**

Walch, Stephen P., Thermoscience Inst., USA; [1996]; 1p; In English; AFOSR HEDM Contractors Meeting, 5-7 Jun. 1996, Boulder, CO, USA; Sponsored by Air Force Office of Scientific Research, Bolling AFB, USA

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

Calculations have been carried out for the HEDM species (cyclic O4, cyclic O3, and cubane) using CASSCF/derivative and CASSCF/ICCI methods. Cyclic O4 is of interest both as a potential HEDM species and because of its possible role in the ozone deficit problem in atmospheric chemistry. We have studied the pathway for decomposition from the D(2d) minimum and also have found the approximate location of the singlet triplet crossing. The barrier to decomposition is found to be about 9 kcal/mol and is not limited by the singlet triplet crossing. For cyclic O3 we have focused on the crossings between the lowest five surfaces (X(1)A(1), s(1)A(1), (1)A(2), (1)B(1), and (1)B(2)) to provide some insight into ways to form cyclic O3 photochemically. The crossing region between the X(1)A(1) and 2(1)A(1) surfaces is in agreement with the work of Xantheas et al. The calculations show that vertical excitation from the ground state to the (1)A(2) state leads to a crossing with the (1)A(1) manifold near the crossing region of the X(1)A(1) and 2(1)A(1) surfaces. We have studied the decomposition pathways for cubane to benzene plus acetylene and to cyclooctatetraene. We have also studied the ground and excited states for the photochemical ring closure step. The state which closes to cubane can be described as a double triplet pi to pi\* excitation with respect to the ground state. Thus, this state has only a small oscillator strength with respect to the ground state. However, there is a singlet pi to pi\* state at nearly the same energy and excitation to this state followed by intersystem crossing could lead to the triplet pi to pi\* state.

Author

*Atomic Energy Levels; Ozone; Electron Transfer; Cubane*

**20020039694** Georgia Tech Research Inst., School of Earth and Atmospheric Sciences, Atlanta, GA USA

**China as an Evolving Metro-Agro-Plex (China-MAP) Final Report, 1 Nov. 2000 - 31 Oct. 2001**

Chameides, William L., Georgia Tech Research Inst., USA; Bergin, M., Georgia Tech Research Inst., USA; Carmichael, G., Iowa Univ., USA; Dickinson, R., Georgia Tech Research Inst., USA; Giorgi, F., International Centre for Theoretical Physics, Italy; Kiang, C. S., Georgia Tech Research Inst., USA; Levy, H., II, Princeton Univ., USA; Kasibhatla, P., Duke Univ., USA; Mearns, L., National Center for Atmospheric Research, USA; Ramaswamy, V., Princeton Univ., USA; [2002]; 6p; In English

Contract(s)/Grant(s): NAG5-9868

Report No.(s): G-35-651; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The one-year NASA-funded project was implemented to complete the analyses and model-simulations undertaken under the auspices of the 3-year research effort supported by NASA as an Interdisciplinary Earth System Science Investigation (IDS) entitled: China As An Evolving Metro-Agro-Plex (China-MAP). The primary goal of China-MAP was to assess the effects of economic development and the regional environmental changes it engenders upon agriculture in China. The project was carried out as part of the Sino-U.S. Science and Technology Protocol in the Atmospheric Sciences, an official government-to-government agreement that establishes the parameters for joint research projects between the two nations in the atmospheric sciences. The NASA-funded portion of the project focused on the development and application of a regional coupled climate/chemical transport model for East Asia (i.e., RegChem-CM). The funds provided under the subject 1-year project were used to: (1) complete specific investigations undertaken by the China-MAP Science Team using the Reg-Chem-CM expended; and (2) document the results of these and other China-MAP investigations in the peer-reviewed literature. A summary of these specific investigations is provided.

Author

*Simulation; Atmospheric Chemistry; Atmospheric Physics; Climate Models; Technologies; Agriculture*

**20020039705** NASA Ames Research Center, Moffett Field, CA USA

**Vertical Transport Processes for Inert and Scavenged Species: TRACE-A Measurements**

Chatfield, Robert B., NASA Ames Research Center, USA; [1997]; 1p; In English; 77th Annual Meeting of the American Meteorological Society, 2-7 Feb. 1997, Long Beach, CA, USA; Sponsored by American Meteorological Society, USA

Contract(s)/Grant(s): RTOP 622-59-39-10; No Copyright; Avail: Issuing Activity; Abstract Only

The TRACE-A mission of the NASA DC-8 aircraft made a large-scale survey of the tropical and subtropical atmosphere in September and October of 1992. Both In-situ measurements of CO (G. Sachsen NASA Langley) and aerosol size (J. Browell group, NASA Langley) provide excellent data sets with which to constrain vertical transport by planetary boundary layer mixing and deep-cloud cumulus convection. Lidar profiles of aerosol-induced scattering and ozone (also by Bremen) are somewhat require more subtle interpretation as tracers, but the vertical information on layering largely compensates for these complexities. The reason this DC-8 dataset is so useful is that very large areas of biomass burning over Africa and South America provide surface sources of appropriate sizes with which to characterize vertical and horizontal motions; the major limitation of our source

description is that biomass burning patterns move considerably every few days, and daily burning inventories are a matter of concurrent, intensive research. We use the Penn State / NCAR MM5 model in an assimilation mode on the synoptic and intercontinental scale, and assess the success it shows in vertical transport descriptions. We find that the general level of emissions suggested by the climatological approach (Will. Has, U. of Montana) appears to be approximately correct, possibly a bit low, for this October, 1992, time period. Vertical transport in planetary boundary layer mixing to 5.5 km was observed and reproduced in our simulations. Furthermore we find evidence that Blackader "transilient" or matrix-transport scheme is needed, but may require some adaptation in our tracer model: CO seems to exhibit very high values at the top of the planetary boundary layer, a process that stretches the eddy-diffusion parameterization. We will report on progress in improving the deep convective transport of carbon monoxide: the Grail scheme as we used it at 100 km resolution did not transport enough material to the upper troposphere. We expect to be able to attribute this to either parameterization reasons (inadequacy of this parameterization at the large 100km scale) or other reasons. Nevertheless, the qualitative nature of deep transport by clouds shows up well in the simulations. As for scavengable species, the simulations predict tens of micrograms per standard cubic meter of smoke aerosol in the boundary layer. In a straightforward illustration of our simple bulk-mass scavenging parameterization, to one or two micrograms per standard cubic meter of smoke aerosol in the free troposphere just above the source regions: very high concentrations for the free troposphere. We expect to report on comparisons of these predictions to a variety of observations.

Author

*Vertical Motion; Tropical Regions; Boundary Layers; Planetary Boundary Layer; Convection; Turbulent Diffusion; Scavenging*

**20020039709** NASA Kennedy Space Center, Cocoa Beach, FL USA

**Simulation of Jet Noise with OVERFLOW CFD Code and Kirchhoff Surface Integral**

Kandula, M., DYNACS Engineering Co., Inc., USA; Caimi, R., NASA Kennedy Space Center, USA; [2002]; 14p; In English; AIAA/CEAS Aeroacoustics Conference, 17-19 Jun. 2002, Breckenridge, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS10-98001

Report No.(s): AIAA Paper 2002-2602; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An acoustic prediction capability for supersonic axisymmetric jets was developed on the basis of OVERFLOW Navier-Stokes CFD (Computational Fluid Dynamics) code of NASA Langley Research Center. Reynolds-averaged turbulent stresses in the flow field are modeled with the aid of Spalart-Allmaras one-equation turbulence model. Appropriate acoustic and outflow boundary conditions were implemented to compute time-dependent acoustic pressure in the nonlinear source-field. Based on the specification of acoustic pressure, its temporal and normal derivatives on the Kirchhoff surface, the near-field and the far-field sound pressure levels are computed via Kirchhoff surface integral, with the Kirchhoff surface chosen to enclose the nonlinear sound source region described by the CFD code. The methods are validated by a comparison of the predictions of sound pressure levels with the available data for an axisymmetric turbulent supersonic (Mach 2) perfectly expanded jet.

Author

*Jet Aircraft Noise; Supersonic Jet Flow; Computational Fluid Dynamics; Axisymmetric Flow; Mathematical Models*

**20020039710** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Estimating Downward Cross-Tropopause Ozone Flux using Column Ozone and Potential Vorticity**

Olsen, Mark A., National Academy of Sciences - National Research Council, USA; Douglass, Anne R., NASA Goddard Space Flight Center, USA; Schoeberl, Mark R., NASA Goddard Space Flight Center, USA; [2001]; 27p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new method of estimating the downward ozone flux across the midlatitude tropopause is introduced. The algorithm derives the estimate from total column ozone observations. Vertical information is given by analysis potential vorticity fields. This method yields an annual estimate of 500 +/- 140 Tg/yr stratospheric injection of ozone into the northern hemisphere, midlatitude troposphere. The downward ozone flux exhibits the expected spring maximum and autumn minimum. The annual distribution of the cross-tropopause ozone, transport by latitude is consistent with the seasonal frequency and (list distribution) of baroclinic systems. This algorithm also produces localized results and call thus be applied to a single case or global studies.

Author

*Ozone; Troposphere; Estimating; Temperate Regions; Atmospheric Composition; Algorithms*

**20020039740** NASA Ames Research Center, Moffett Field, CA USA

**An Assessment of the Scientific Basis Behind Global Environmental Concerns in the 21st Century**

Singh, Hanwant B., NASA Ames Research Center, USA; [2001]; 1p; In English; Award Lecture, 11 Aug. 2001, New Delhi, India  
Contract(s)/Grant(s): RTOP 622-63-01; No Copyright; Avail: Issuing Activity; Abstract Only

The notion that human activities may endanger the earth's environment has emerged as a leading societal concern in the post industrial era. Under the ever increasing pressures of population growth and industrialization, the problems of local air pollution have now become matters of both local and global concern. Smog, toxic chemicals, acid rain, ozone depletion, and climate change have become household words and an intense public policy debate about the cost and benefits of environmental protection continues. There is a growing realization that the consequences of air pollution can be felt in unpredictable ways in near and far away places. Unpopulated regions of the world such as the arctic now suffer from arctic haze and ozone depletions are the largest in the Antarctic stratosphere. In the last 40 years three decades many countries have instituted ambient air quality standards designed to mitigate problems of health and welfare associated with the release of chemicals. Global agreements to prevent the depletion of ozone layer and to slow down climatic warming are being actively debated and formulated. In parallel there has been an intense exploration of the science of air pollution all over the world. The scientific basis behind environmental concerns is imperfect and is central to this debate. I will review our current scientific understanding of some of the major environmental concerns. An assessment of the forthcoming efforts to put this science on a more solid footing will be provided.

Author

*Environment Protection; Climatology; Air Pollution; Atmospheric Chemistry*

**20020039742** NASA Ames Research Center, Moffett Field, CA USA

### **In Situ Measurement of Aerosol Extinction**

Strawa, Anthony W., NASA Ames Research Center, USA; Castaneda, R., NASA Ames Research Center, USA; Owano, T. G., Informed Diagnostics, Inc., USA; Bear, D., Informed Diagnostics, Inc., USA; [2001]; 1p; In English; Chapman Conference on Atmospheric Absorption of Radiation, 12-17 2001, Unknown; Sponsored by Chapman Research Group, Inc., USA; No Copyright; Avail: Issuing Activity; Abstract Only

Aerosols are important contributors to the radiative forcing in the atmosphere. Much of the uncertainty in our knowledge of climate forcing is due to uncertainties in the radiative forcing due to aerosols as illustrated in the IPCC reports of the last ten years. Improved measurement of aerosol optical properties, therefore, is critical to an improved understanding of atmospheric radiative forcing. Additionally, attempts to reconcile in situ and remote measurements of aerosol radiative properties have generally not been successful. This is due in part to the fact that it has been impossible to measure aerosol extinction in situ in the past. In this presentation we introduce a new instrument that employs the techniques used in cavity ringdown spectroscopy to measure the aerosol extinction and scattering coefficients in situ. A prototype instrument has been designed and tested in the lab and the field. It is capable of measuring aerosol extinction coefficient to  $2 \times 10^{-6}$  per meter. This prototype instrument is described and results are presented.

Author

*Aerosols; In Situ Measurement; Prototypes; Spectroscopy; Optical Properties*

**20020039793** NASA Goddard Space Flight Center, Greenbelt, MD USA

### **Estimating Net Primary Productivity Using Satellite and Ancillary Data**

Choudhury, B. J., NASA Goddard Space Flight Center, USA; [2001]; 2p; In English; 53rd International Astronautical Congress Meeting, 10-19 Oct. 2002, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The net primary productivity (C) or annual rate of carbon accumulation per unit ground area by terrestrial plant communities is the difference of the rate of gross photosynthesis ( $A_{sub g}$ ) and autotrophic respiration (R) per unit ground area. Although available observations show that R is a large and variable fraction of  $A_{sub g}$ , viz., 0.3 to 0.7, it is generally recognized that much uncertainties exist in this fraction due to difficulties associated with the needed measurements. Additional uncertainties arise when these measurements are extrapolated to regional or global land surface using empirical equations, for example, using regression equations relating C to mean annual precipitation and air temperature. Here, a process-based approach has been taken to calculate  $A_{sub g}$  and R using satellite and ancillary data.  $A_{sub g}$  has been expressed as a product of radiation use efficiency, magnitude of intercepted photosynthetically active radiation (PAR), and normalized by stresses due to soil water shortage and air temperature away from the optimum range. A biophysical model has been used to determine the radiation use efficiency from the maximum rate of carbon assimilation by a leaf, foliage temperature, and the fraction of diffuse PAR incident on a canopy. All meteorological data (PAR, air temperature, precipitation, etc.) needed for the calculation are derived from satellite observations, while a land use, land cover data (based on satellite and ground measurements) have been used to assess the maximum rate of carbon assimilation by a leaf of varied cover type based on field measurements. R has been calculated as the sum of maintenance and growth components. The maintenance respiration of foliage and live fine roots at a standard temperature of different land cover has been determined from their nitrogen content using field and satellite measurements, while that of living fraction of woody stem (viz., sapwood) from the seasonal maximum leaf area index as determined from satellite observations. These maintenance respiration values were then adjusted to that corresponding to air temperature according to a prescribed non-linear variation of respiration

with temperature. The growth respiration has been calculated from the difference of Ag and maintenance respiration, according to the two-compartment model. The results of calculations will be reported for 36 consecutive months (1987-1989) over large contiguous areas (ca. 10(exp 5) sq km) Of agricultural land and tropical humid evergreen forests, and compared with available field data.

Author

*Carbon; Productivity; Photosynthetically Active Radiation; Satellite Observation; Agriculture*

**20020039794** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Intercomparison of Satellite Derived Gravity Time Series with Inferred Gravity Time Series from TOPEX/POSEIDON Sea Surface Heights and Climatological Model Output**

Cox, C., NASA Goddard Space Flight Center, USA; Au, A., NASA Goddard Space Flight Center, USA; Klosko, S., NASA Goddard Space Flight Center, USA; Chao, B., NASA Goddard Space Flight Center, USA; [2001]; 1p; In English; 26th European Geophysical Society Meeting, 25-30 Mar. 2001, Nice, France; Sponsored by European Geophysical Society, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

The upcoming GRACE mission promises to open a window on details of the global mass budget that will have remarkable clarity, but it will not directly answer the question of what the state of the Earth's mass budget is over the critical last quarter of the 20th century. to address that problem we must draw upon existing technologies such as SLR, DORIS, and GPS, and climate modeling runs in order to improve our understanding. Analysis of long-period geopotential changes based on SLR and DORIS tracking has shown that addition of post 1996 satellite tracking data has a significant impact on the recovered zonal rates and long-period tides. Interannual effects such as those causing the post 1996 anomalies must be better characterized before refined estimates of the decadal period changes in the geopotential can be derived from the historical database of satellite tracking. A possible cause of this anomaly is variations in ocean mass distribution, perhaps associated with the recent large El Nino/La Nina. In this study, a low-degree spherical harmonic gravity time series derived from satellite tracking is compared with a TOPEX/POSEIDON-derived sea surface height time series. Corrections for atmospheric mass effects, continental hydrology, snowfall accumulation, and ocean steric model predictions will be considered.

Author

*Climate Models; Mass Distribution; Air Masses; Periodic Variations*

**20020040120** National Center for Atmospheric Research, Boulder, CO USA

**Seasonal Predictability of the Regional Climate of the Mississippi River Basin Final Report**

Tribbia, Joseph, National Center for Atmospheric Research, USA; Giorgi, Filippo, National Center for Atmospheric Research, USA; [2002]; 3p; In English; Diskette: 1 3.5-inch DSHD diskette

Contract(s)/Grant(s): NAG8-1525

Report No.(s): NCAR-97-144; NONP-NASA-DK-2002065386; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This is a report on our accomplishments during the previous year and our wrap-up plans for the coming months for our work in studying the seasonal predictability of precipitation over the Mississippi River Basin. The work accomplished during the grant falls into two broad categories: (1) diagnosis of regional skill of CCM3; and (2) regional and global model development.

Derived from text

*Climate; Weather Forecasting; River Basins; Precipitation (Meteorology)*

**20020040777** Oak Ridge National Lab., TN USA

**Catalyzed Diesel Particulate Filter Performance in a Light-Duty Vehicle**

Sluder, C. S., Oak Ridge National Lab., USA; Apr. 23, 2001; 11p; In English

Report No.(s): DE2002-788724; P00-108513; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Light-duty chassis dynamometer driving cycle tests were conducted on a Mercedes A170 diesel vehicle with various sulfur-level fuels and exhaust emission control systems. Triplicate runs of a modified light-duty federal test procedure (FTP), US06 cycle, and SCO3 cycle were conducted with each exhaust configuration and fuel. Ultra-low sulfur (3-ppm) diesel fuel was doped to 30- and 150-ppm sulfur so that all other fuel properties remained the same. The fuels used in these experiments met the specifications of the fuels from the DECSE (Diesel Emission Control Sulfur Effects) program. Although the Mercedes A170 vehicle is not available in the US, its emissions in the as tested condition fell within the U.S. Tier 1 full useful life standards with the OEM catalysts installed. Tests with the OEM catalysts removed showed that the OEM catalysts reduced PM emissions from the engine-out condition by 30-40% but had negligible effects on NOx emissions. Fuel sulfur level had very little effect on the OEM catalyst performance. A prototype catalyzed diesel particulate filter (CDPF) mounted in an underfloor configuration

reduced particulate matter emissions by more than 90% compared to the factory emissions control system. The results show that the CDPF did not promote any significant amounts of SO(sub 2)-to-sulfate conversion during these light-duty drive cycles.

NTIS

*Catalysts; Diesel Fuels; Sulfur; Automatic Control; Diesel Engines*

## 46

### GEOPHYSICS

*Includes earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see 47 Meteorology and Climatology; and 93 Space Radiation.*

**20020039144** NASA Goddard Space Flight Center, Greenbelt, MD USA

#### **Chemistry-Climate Models of the Stratosphere**

Austin, J., Meteorological Office, UK; Shindell, D., NASA Goddard Inst. for Space Studies, USA; Bruehl, C., Max-Planck-Inst. fuer Chemie, Germany; Dameris, M., Deutsche Gesellschaft fuer Luft- und Raumfahrt, Germany; Manzini, E., Max-Planck-Inst. fuer Meteorologie, Germany; Nagashima, T., Tokyo Univ., Japan; Newman, P., NASA Goddard Space Flight Center, USA; Pawson, S., NASA Goddard Space Flight Center, USA; Pitari, G., Aquila Univ., Italy; Rozanov, E., Eidgenoessische Technische Hochschule, Switzerland; [2001]; 30p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over the last decade, improved computer power has allowed three-dimensional models of the stratosphere to be developed that can be used to simulate polar ozone levels over long periods. This paper compares the meteorology between these models, and discusses the future of polar ozone levels over the next 50 years.

Author

*Ozone; Stratosphere; Three Dimensional Models; Polar Regions; Atmospheric Chemistry*

**20020039169** Massachusetts Inst. of Tech., Dept. of earth, Atmospheric and Planetary Sciences, Cambridge, MA USA

#### **Physical Mechanisms Controlling Upper Tropospheric Water Vapor as Revealed by MLS Data from UARS Final Report, 1 Dec. 1997 - 30 Nov. 2001**

Newell, Reginald E., Massachusetts Inst. of Tech., USA; Feb. 27, 2002; 4p; In English

Contract(s)/Grant(s): NAG5-6710; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The third year and final report on the physical mechanisms controlling upper tropospheric water vapor revealed by the Microwave Limb Sounder (MLS) on the Upper Atmosphere Research Satellite (UARS) is presented.

CASI

*Troposphere; Upper Atmosphere Research Satellite (UARS); Water Vapor; Microwave Sounding; Data Acquisition*

**20020039294** Geophysical Observatory, Sodankyla, Finland

#### **Magnetic Results: Sodankyla, 2000**

Kultima, Johannes, Editor, Geophysical Observatory, Finland; 2002; ISSN 1456-3673; 40p; In English

Report No.(s): Rept-90; ISBN 951-42-6026-0; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Sodankyla Geophysical Observatory was established in 1913; 1914 was the first year of magnetic recordings. The observatory is situated on the east bank of the river Karmen, ca. 5 km south of Sodankyla village. Until 31.07.1997 it belonged to the Finnish Academy of Science and Letters. Since 01.08.1997 it has been the independent, nation-wide observatory of the University of Oulu.

Derived from text

*Geophysical Observatories; Variometers*

**20020039296** Lembaga Penerbangan dan Antariksa Nasional, Pusat Pemanfaatan Sains Antariksa, Jakarta, Indonesia

#### **Impact of Geomagnetic Activity to the Ionosphere Layer Dampak Aktivitas Geomagnet Terhadap Lapisan Ionosfer**

Ruhimat, Mamat, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Jiyo, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Satria, Eddy Indra, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Suryaman, Dodi, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; March 2001; ISSN 0126-9754; Volume 3, No. 1, pp. 15-18; In Malay-Indonesian; Copyright; Avail: Issuing Activity

Ionosphere is one of natural phenomenon that contains ions and electrons. This is become a reflector medium of HF radio wave. It is influenced by solar and geomagnetic activities. The influences of geomagnetic activity to ionosphere will be presented in this paper. The analysis results indicate that there is a strong correlation between the geomagnetic activity and ionospheric

parameters. The geomagnetic disturbance influenced the decrease of the critical frequency  $f_oF_2$  and it was one to three hours later after the disturbance.

Author

*Geomagnetism; Magnetic Disturbances; Ionospheres; Radio Waves*

**20020039319** Lembaga Penerbangan dan Antariksa Nasional, Bidang Komunikasi HF, Jakarta, Indonesia

**Correlation Between the Zonal Wind of Lower Atmosphere and  $f_{min}$  Over Biak** *Hubungan Antara Angin Zonal di Atmosfer Bawah dan  $f_{min}$  di Atas Biak*

Mumen, T., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Sjarifuddin, M., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Djamaluddin, T., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; October 2000; ISSN 0126-9754; Volume 2, No. 4, pp. 131-136; In Malay-Indonesian; Copyright; Avail: Issuing Activity

Ionospheric layer (upper atmosphere) has an important role as reflection of high frequency waves because it contains charged particle. Lower atmosphere winds can change distribution of charged particle in the ionosphere, resulting ionospheric minimum frequency change (one of high frequency wave absorption indicator). Using zonal wind and  $f_{min}$  data of Biak (01 deg 08 min 39 sec S; 136 deg 02 min 46 sec E), it is found that time interval of 6 days between  $f_{min}$  enhancements and reversal of stratospheric zonal wind direction from westward to eastward over stratosphere (about 27 km high).

Author

*Wind (Meteorology); Lower Atmosphere; Charged Particles*

**20020039324** Lembaga Penerbangan dan Antariksa Nasional, Bidang Komunikasi HF, Jakarta, Indonesia

**Multi-Quadric Method Application for the Indonesian Ionosphere  $f_oF_2$  Mapping** *Penerapan Metode Multiquadric Untuk Pemetaan  $f_oF_2$  Ionosfer Indonesia*

Jiyo, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; October 2000; ISSN 0126-9754; Volume 2, No. 4, pp. 154-158; In Malay-Indonesian; Copyright; Avail: Issuing Activity

In this paper we discuss the Multiquadric method for regional mapping of  $f_oF_2$ . This method can be used to make a map for region with irregular observation. Mathematically, the mapping method is simple and easy to apply. Application of the method for mapping the ionospheric  $f_oF_2$  over Indonesia shows that there is increasing of  $f_oF_2$  in the morning and latitudinal variation. It is characteristic of equatorial anomaly.

Author

*Mapping; Indonesia; Ionospherics*

**20020039326** Lembaga Penerbangan dan Antariksa Nasional, Bidang Komunikasi HF, Jakarta, Indonesia

**Empirical Relationship Between Frequency  $f_oF_2$  and Sunspot Number (R) with Longitude Lambda at a Certain Altitude Over Indonesia** *Hubungan Empiris Antara Frekuensi  $f_oF_2$  Dengan Bilangan Sunspot (R) dan Derajat Bujur (Lambda) Pada Lintang Tertentu di Atas Indonesia*

Budiyanto, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Muslim, Buldan, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Habirun, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Suparman, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; October 2000; ISSN 0126-9754; Volume 2, No. 4, pp. 159-164; In Malay-Indonesian; Copyright; Avail: Issuing Activity

Determination of frequency  $f_oF_2$  of the ionosphere over regions that can not be covered by vertical ionosonde monitoring is carried out through the empirical relationship between frequency  $f_oF_2$  and sunspot number R with longitude lambda at a certain altitude. Especially on equator  $\phi = 0$  over Indonesian region the empirical relation is  $f_oF_2 = (14.6261 - 0.0441 * \lambda) - (0.0357 - 0.0004 * \lambda) * R$  with  $(14.6261 - 0.0441 * \lambda)$  and  $(0.0357 - 0.0004 * \lambda)$  is empirical relationship between regression parameter with lambda (longitude) in Indonesian region. This empirical relationship have mean error 3.39%. by the empirical relation, on the position of  $(0, \lambda)$  with certain lambda and R known by prediction, we get prediction frequency  $f_oF_2$  on that position. Finally it can be determine frequency HF communication through that region.

Author

*Numerical Analysis; F 2 Region; Sunspots; Critical Frequencies*

**20020039329** NASA Ames Research Center, Moffett Field, CA USA

**Tracer-Based Determination of Vortex Descent in the 1999-2000 Arctic Winter**

Greenblatt, Jeffery B., Princeton Univ., USA; Jost, Hans-Juerg, NASA Ames Research Center, USA; Loewenstein, Max, NASA Ames Research Center, USA; Podolske, James R., NASA Ames Research Center, USA; Hurst, Dale F., National Oceanic and Atmospheric Administration, USA; Elkins, James W., National Oceanic and Atmospheric Administration, USA; Schauffler, Sue

M., National Center for Atmospheric Research, USA; Atlas, Elliot L., National Center for Atmospheric Research, USA; Herman, Robert L., Jet Propulsion Lab., California Inst. of Tech., USA; Webster, Christopher R., Jet Propulsion Lab., California Inst. of Tech., USA; [2001]; 70p; In English

Contract(s)/Grant(s): RTOP 622-65-15-10; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A detailed analysis of available in situ and remotely sensed N<sub>2</sub>O and CH<sub>4</sub> data measured in the 1999-2000 winter Arctic vortex has been performed in order to quantify the temporal evolution of vortex descent. Differences in potential temperature (theta) among balloon and aircraft vertical profiles (an average of 19-23 K on a given N<sub>2</sub>O or CH<sub>4</sub> isopleth) indicated significant vortex inhomogeneity in late fall as compared with late winter profiles. A composite fall vortex profile was constructed for November 26, 1999, whose error bars encompassed the observed variability. High-latitude, extravortex profiles measured in different years and seasons revealed substantial variability in N<sub>2</sub>O and CH<sub>4</sub> on theta surfaces, but all were clearly distinguishable from the first vortex profiles measured in late fall 1999. From these extravortex-vortex differences, we inferred descent prior to November 26: 397+/-15 K (1sigma) at 30 ppbv N<sub>2</sub>O and 640 ppbv CH<sub>4</sub>, and 28+/-13 K above 200 ppbv N<sub>2</sub>O and 1280 ppbv CH<sub>4</sub>. Changes in theta were determined on five N<sub>2</sub>O and CH<sub>4</sub> isopleths from November 26 through March 12, and descent rates were calculated on each N<sub>2</sub>O isopleth for several time intervals. The maximum descent rates were seen between November 26 and January 27: 0.82+/-0.20 K/day averaged over 50-250 ppbv N<sub>2</sub>O. by late winter (February 26-March 12), the average rate had decreased to 0.10+/-0.25 K/day. Descent rates also decreased with increasing N<sub>2</sub>O; the winter average (November 26-March 5) descent rate varied from 0.75+/-0.10 K/day at 50 ppbv to 0.40+/-0.11 K/day at 250 ppbv. Comparison of these results with observations and models of descent in prior years showed very good overall agreement. Two models of the 1999-2000 vortex descent, SLIMCAT and REPROBUS, despite theta offsets with respect to observed profiles of up to 20 K on most tracer isopleths, produced descent rates that agreed very favorably with the inferred rates from observation.

Author

*Vortices; Nitrogen Oxides; Inhomogeneity; Methane*

**20020039334** Aerospace Corp., Space Science Applications Lab., Germantown, MD USA

**SOLARMAX/Electron Pitch Angle Anisotropy Distributions Final Report, 1 Jun. 2000 - 31 Dec. 2001**

McKenzie, David L., Aerospace Corp., USA; Anderson, Phillip C., Aerospace Corp., USA; Mar. 20, 2002; 4p; In English

Contract(s)/Grant(s): NAG5-9646; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This final research report summarizes the scientific work performed by The Aerospace Corporation on SOLARMAX/Electron Pitch Angle Anisotropy Distributions. The period of performance was from June 1, 2000 to December 31, 2001.

CASI

*Anisotropy; Electron Energy; Imaging Techniques; Angular Distribution; Solar Maximum Mission*

**20020039741** NASA Ames Research Center, Moffett Field, CA USA

**Microphysical Modelling of the 1999-2000 Arctic Winter, 2, Chlorine Activation and Ozone Depletion**

Drdla, K., NASA Ames Research Center, USA; Schoeberl, M. R., NASA Ames Research Center, USA; [2001]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The effect of a range of assumptions about polar stratospheric clouds (PSCs) on ozone depletion has been assessed using a couple microphysical/photochemical model. The composition of the PSCs was varied (ternary solutions, nitric acid trihydrate, nitric acid dehydrate, or ice), as were parameters that affected the levels of denitrification and dehydration. Ozone depletion was affected by assumptions about PSC freezing because of the variability in resultant nitrification chlorine activation in all scenarios was similar despite the range of assumed PSC compositions. Vortex-average ozone loss exceeded 40% in the lower stratosphere for simulations without nitrification an additional ozone loss of 15-20% was possible in scenarios where vortex-average nitrification reached 60%. Ozone loss intensifies non-linearly with enhanced nitrification in air parcels with 90% nitrification 40% ozone loss in mid-April can be attributed to nitrification alone. However, these effects are sensitive to the stability of the vortex in springtime: nitrification only began to influence ozone depletion in mid-March.

Author

*Arctic Regions; Winter; Photochemical Reactions; Mathematical Models; Chlorine; Ozone Depletion; Stratosphere*

**20020039746** NASA Ames Research Center, Moffett Field, CA USA

**Evidence for the Widespread Presence of Liquid-Phase Particles During the 1999-2000 Arctic Winter**

Drdla, K., NASA Ames Research Center, USA; Gandrud, B. W., NASA Ames Research Center, USA; Baumgardner, D., NASA Ames Research Center, USA; Wilson, J. C., NASA Ames Research Center, USA; Bui, T. P., NASA Ames Research Center, USA; [2001]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

In-situ Multi-Angle Spectrometer Probe (MASP) particle measurements have been analyzed to determine the typical behaviour of sulphate particles during the SOLVE campaign. The analysis has focussed on variations in the total particle concentration measured by MASP, which is a diagnostic that is primarily sensitive to the growth of small particles (those which are initially smaller than 0.2 micrometers in radius). At all levels of the stratosphere, the total MASP concentration varies continuously with temperature. This behaviour is well-reproduced by assuming that the sulphate aerosols are liquid ternary solutions, but cannot be reproduced if the aerosol is assumed to be frozen. This liquid-like behaviour is apparent for all measurements made during SOLVE, both inside and outside the vortex, and even at the coldest temperatures sampled during the campaign. The only anomalous measurements were made during the flight of January 14th, 2001; however, this midlatitude flight is very unlikely to contain SAT particles based on the recent warm temperatures experienced by the air. At the levels with the coldest measured temperatures, at least 90% of the particles grow as liquids. Therefore, the freezing that occurred during the 1999-2000 Arctic winter was selective, causing most of the particles to remain liquid even in the presence of a small number of frozen particles.

Author

*Liquid Phases; Winter; Arctic Regions; Particles; Sulfates*

**20020039802** Wyoming Univ., Dept. of Atmospheric Science, Laramie, WY USA

**Evaluation of SAGE II and Balloon-Borne Stratospheric Aerosol Measurements: Evaluation of Aerosol Measurements from SAGE II, HALOE, and Balloonborne Optical Particle Counters *Final Report***

Hervig, Mark, Wyoming Univ., USA; Deshler, Terry, Wyoming Univ., USA; Journal of Geophysical Research; 2002; ISSN 0148-0227; Volume 107, No. D3, pp. 3-1 - 3-12; In English

Contract(s)/Grant(s): NAG1-2164

Report No.(s): Paper-2001JD000703; Copyright; Avail: Issuing Activity

Stratospheric aerosol measurements from the University of Wyoming balloonborne optical particle counters (OPCs), the Stratospheric Aerosol and Gas Experiment (SAGE) II, and the Halogen Occultation Experiment (HALOE) were compared in the period 1982-2000, when measurements were available. The OPCs measure aerosol size distributions, and HALOE multiwavelength (2.45-5.26 micrometers) extinction measurements can be used to retrieve aerosol size distributions. Aerosol extinctions at the SAGE II wavelengths (0.386-1.02 micrometers) were computed from these size distributions and compared to SAGE II measurements. In addition, surface areas derived from all three experiments were compared. While the overall impression from these results is encouraging, the agreement can change with latitude, altitude, time, and parameter. In the broadest sense, these comparisons fall into two categories: high aerosol loading (volcanic periods) and low aerosol loading (background periods and altitudes above 25 km). When the aerosol amount was low, SAGE II and HALOE extinctions were higher than the OPC estimates, while the SAGE II surface areas were lower than HALOE and the OPCS. Under high loading conditions all three instruments mutually agree to within 50%.

Author

*Aerosols; Halogen Occultation Experiment; Balloon-Borne Instruments; Sage Satellite; Radiation Counters; Optical Measuring Instruments; Atmospheric Composition*

**20020039835** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Atmospheric Science Research Using Raman Lidar at NASA/GSFC**

Whiteman, David N., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Atmospheric Research Using Raman Lidar at GSFC, 19-20 Feb. 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A broad overview of the research that is taking place in the Code 924 Raman Lidar group will be presented. The measurement capabilities of two instruments, the Scanning Raman Lidar (SRL) and the Raman Airborne Spectroscopic Lidar (RASL), will be discussed. Case studies to be presented include: 1) high resolution measurements of water vapor during a boundary layer bore wave event; 2) a study of the influence of thin cirrus clouds on satellite retrievals of water vapor; 3) the retrieval of warm cloud properties such as droplet radius and number density; and 4) remote aerosol characterization using multiwavelength lidar and others.

Author

*Water Vapor; Cirrus Clouds; Optical Radar; Meteorology; High Resolution; Aerosols*

**20020039864** MRJ, Inc., Moffett Field, CA USA

**Machine Phase Fullerene Nanotechnology: 1996**

Globus, Al, MRJ, Inc., USA; [1997]; 3p; In English; Electrochemical Society's 191st Meeting, 4-9 May 1997, Montreal, Quebec, Canada; Sponsored by Electrochemical Society, Inc., USA

Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

NASA has used exotic materials for spacecraft and experimental aircraft to good effect for many decades. In spite of many advances, transportation to space still costs about \$10,000 per pound. Drexler has proposed a hypothetical nanotechnology based on diamond and investigated the properties of such molecular systems. These studies and others suggest enormous potential for aerospace systems. Unfortunately, methods to realize diamond nanotechnology are at best highly speculative. Recent computational efforts at NASA Ames Research Center and computation and experiment elsewhere suggest that a nanotechnology of machine phase functionalized fullerenes may be synthetically relatively accessible and of great aerospace interest. Machine phase materials are (hypothetical) materials consisting entirely or in large part of microscopic machines. In a sense, most living matter fits this definition. To begin investigation of fullerene nanotechnology, we used molecular dynamics to study the properties of carbon nanotube based gears and gear/shaft configurations. Experiments on C60 and quantum calculations suggest that benzyne may react with carbon nanotubes to form gear teeth. Han has computationally demonstrated that molecular gears fashioned from (14,0) single-walled carbon nanotubes and benzyne teeth should operate well at 50-100 gigahertz. Results suggest that rotation can be converted to rotating or linear motion, and linear motion may be converted into rotation. Preliminary results suggest that these mechanical systems can be cooled by a helium atmosphere. Furthermore, Deepak has successfully simulated using helical electric fields generated by a laser to power fullerene gears once a positive and negative charge have been added to form a dipole. Even with mechanical motion, cooling, and power; creating a viable nanotechnology requires support structures, computer control, a system architecture, a variety of components, and some approach to manufacture. Additional information is contained within the original extended abstract.

Author

*Carbon Nanotubes; Fullerenes; Molecular Dynamics; Nanotechnology*

**20020039917** Stanford Univ., Space Telecommunications and Radioscience Lab., Stanford, CA USA

**Very Low Frequency (VLF) Remote Sensing of Gravity Waves Generated by the Auroral Electrojet *Final Report, 1 Jun. 1997-31 Dec. 2000***

Bell, T. F.; Inan, U. S.; Demirkol, M. K.; Chevalier, M. W.; Moore, R.; Jan. 14, 2002; 6p; In English

Contract(s)/Grant(s): GF49620-97-1-0468

Report No.(s): AD-A399159; AFRL-SR-BL-TR-02-0050; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the period of performance the VLF remote diagnostic technique was applied in order to characterize both the ambient and modified D-region when perturbed by atmospheric gravity waves generated by the auroral electrojet. The characterization involved VLF sub-ionospheric wave phase and amplitude measurements at four sites located in Alaska and four sites located along the east coast of the North American continent. A total of ten separate propagation paths were monitored. A large number of gravity wave events were captured that exhibited features consistent with impulsive generation by the auroral electrojet. Measured VLF sub-ionospheric wave amplitudes were perturbed by as much as 3 dB by the gravity waves. The measured VLF wave amplitude and phase perturbations were consistent with a vertical displacement of the D-region driven by the gravity waves. We conclude that gravity waves excited by the auroral electrojet can have significant effects upon the amplitude and phase of sub-ionospheric VLF waves.

DTIC

*Auroral Electrojets; Gravity Waves; Remote Sensing; Wave Propagation*

**20020039967** Wyoming Univ., Laramie, WY USA

**Evaluation of SAGE II and Balloon-Borne Stratospheric Aerosol Measurements *Final Report***

[2002]; 3p; In English

Contract(s)/Grant(s): NAG1-2164; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Under funding from this proposal we evaluated measurements of stratospheric sulfate aerosols from three platforms. Two were satellite platforms providing solar extinction measurements, the Stratospheric Aerosol and Gas Experiment (SAGE) II using wavelengths from 0.386 - 1.02 microns, and the Halogen Occultation Experiment (HALOE) using wavelengths from 2.45 to 5.26 microns. The third set of measurements was from in situ sampling by balloonborne optical particle counters (OPCs). The goal was to determine the consistency among these data sets. This was accomplished through analysis of the existing measurement records, and through additional balloonborne OPC flights coinciding with new SAGE II observations over Laramie, Wyoming. All analyses used the SAGE II v 6.0 data. This project supported two balloon flights per year over Laramie dedicated to SAGE

II coincidence. Because logistical factors, such as poor surface weather or unfavorable payload impact location, can make it difficult to routinely obtain close coincidences with SAGE II, we attempt to conduct nearly every Laramie flight (roughly one per month) in conjunction with a SAGE II overpass. The Laramie flight frequency has varied over the years depending on field commitments and funding sources. Current support for the Laramie measurements is from the National Science Foundation in addition to support from this NASA grant. We have also completed a variety of comparisons using aerosol measurements from SAGE II, OPCs, and HALOE. The instruments were compared for their various estimates of aerosol extinction at the SAGE II wavelengths and for aerosol surface area. Additional results, such as illustrated here, can be found in a recently accepted manuscript describing comparisons between SAGE II, HALOE, and OPCs for the period 1982 - 2000. While overall, the impression from these results is encouraging, the agreement of the measurements changes with latitude, altitude, time, and parameter. In the broadest sense, these comparisons fall into two categories: high aerosol loading (volcanic periods) and low aerosol loading (background periods and altitudes above 25 km). When the aerosol amount is low SAGE II and HALOE extinctions are higher than the OPC estimates, while the SAGE II surface areas are lower than HALOE and the OPCS. Under high loading conditions, all three instruments mutually agree to within 50%.

Author

*Stratosphere; Aerosols; Sulfates; Balloon Flight; Particle Size Distribution*

**20020039982** NASA Ames Research Center, Moffett Field, CA USA

**Surface Measurements of Solar Spectral Radiative Flux in the Cloud-Free Atmosphere**

Pilewskie, Peter, NASA Ames Research Center, USA; Goetz, A. F. H., NASA Ames Research Center, USA; Bergstrom, R., NASA Ames Research Center, USA; Beal, D., NASA Ames Research Center, USA; [1997]; 1p; In English; 77th Annual Meeting of the American Meteorological Society, 2-4 Feb. 1997, Long Beach, CA, USA; Sponsored by American Meteorological Society, USA

Contract(s)/Grant(s): RTOP 622-43-01-10; No Copyright; Avail: Issuing Activity; Abstract Only

Recent studies (Charlock, et al.; Kato, et. al) have indicated a potential discrepancy between measured solar irradiance in the cloud-free atmosphere and model derived downwelling solar irradiance. These conclusions were based primarily on broadband integrated solar flux. Extinction (both absorption and scattering) phenomena, however, typically have spectral characteristics that would be present in moderate resolution (e.g., 10 nm) spectra, indicating the need for such measurements to thoroughly investigate the cause of any discrepancies. The 1996 Department of Energy Atmospheric Radiation Measurement Program (ARM) Intensive Observation Period (IOP), held simultaneously with the NASA Subsonic Aircraft: Contrail and Cloud Effects Special Study (SUCCESS) Program, provided an opportunity for two simultaneous but independent measurements of moderate resolution solar spectral downwelling irradiance at the surface. The instruments were the NASA Ames Solar Spectral Flux Radiometer and the Analytical Spectral Devices, Inc., FieldSpecT-FR. Spectral and band integrated quantities from both sets of measurements will be presented, along with estimates of the downwelling solar irradiance from band model and line by line calculations, in an effort to determine the compatibility between measured and calculated solar irradiance in the cloud-free atmosphere.

Author

*Solar Radiation; Surface Properties; Solar Spectra; Atmospheric Radiation; Radiation Measurement; Clouds (Meteorology)*

**20020040087** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Large Scale Deformation of the Western U.S. Cordillera Final Report, 15 Feb. 1999 - 31 Jan. 2002**

Bennett, Richard A., Smithsonian Astrophysical Observatory, USA; April 2002; 12p; In English

Contract(s)/Grant(s): NAG5-8226; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overall objective of the work that was conducted was to understand the present-day large-scale deformations of the crust throughout the western USA and in so doing to improve our ability to assess the potential for seismic hazards in this region. to address this problem, we used a large collection of Global Positioning System (GPS) networks which spans the region to precisely quantify present-day large-scale crustal deformations in a single uniform reference frame. Our results can roughly be divided into an analysis of the GPS observations to infer the deformation field across and within the entire plate boundary zone and an investigation of the implications of this deformation field regarding plate boundary dynamics.

Author

*Deformation; Earth Crust; USA; Seismology; Plates (Tectonics)*

**20020040391** Johns Hopkins Univ., Dept. of Chemistry, Baltimore, MD USA

**Nonadiabatic Processes Relevant to HEDMs and Atmospheric Chemistry Final Report, 15 Apr. 1999-14 Dec. 2001**

Yarkony, David R.; Feb. 02, 2002; 11p; In English

Contract(s)/Grant(s): F49620-99-1-0198; Proj-2303

Report No.(s): AD-A399437; AFRL-SR-BL-TR-02-0067; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our research focuses on the electronic structure aspects of electronically non adiabatic processes relevant to the stability and combustion of high energy density materials (HEDMs) and atmospheric chemistry. Our funded research has focused on two problems the reaction of B(P-2) with H<sub>2</sub> and reaction O(P-3) + H<sub>2</sub>O right arrow OH(X(sup 2)II) + OH(A2(sup 2)Sigma(+)). Perhaps the most potentially influential aspect of our research is our work on how the connectivity of points conical intersection impacts nonadiabatic events. In each of these systems unanticipated aspects of the loci of these seams of conical intersection has lead to new avenues of research. In the course of our previous AFOSR funded research we demonstrated that B-H<sub>2</sub> exhibits a confluence, an intersection of two branches of same seam of conical intersection, a feature of conical intersections unknown a decade ago. Recently we have shown that confluences can exist not just in tri-atomic molecules but in polyatomic molecules as well and developed an efficient method for locating and characterizing confluences. Our study of the O(P-3) + H<sub>2</sub>O reaction suggests the existence of an alternative coalescence, a subspace of nuclear coordinate space in which two distinct seam coalesce. While intersections of three states are well known when there is symmetry they appear to be essentially unknown for general polyatomic systems.

DTIC

*Nonadiabatic Conditions; Atmospheric Chemistry; Electronic Structure*

**20020040872** Aerospace Corp., Lab. Operations, El Segundo, CA USA

**Energetic Magnetosheath Ions Connected to the Earth's Bow Shock: Possible Source of CEPs**

Chang, S. W.; Scudder, J. D.; Fennell, J. F.; Friedel, R.; Lepping, R. P.; Dec. 20, 2001; 40p; In English; Original contains color images

Contract(s)/Grant(s): F04701-00-C-0009

Report No.(s): AD-A399602; TR-2000(8570)-3; SMC-TR-02-06; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Plasma and magnetic field data detected by NASA GGS/POLAR and WIND during the May 4, 1998 storm event are analyzed to demonstrate for the first time a causal relation between the magnetosheath energetic ions and bow shock magnetic geometry. Intense magnetosheath energetic ions observed upstream from the cusp are from the quasi-parallel bow shock and show properties indicating that they are a possible source of cusp energetic ions (CEPs).

DTIC

*Shock Waves; Bow Waves; Ions; Magnetosheath*

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### METEOROLOGY AND CLIMATOLOGY

*Includes weather observation forecasting and modification*

**20020039152** Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

**Monthly Rainfall Analysis Using Outgoing Longwave Radiation (OLR) Data in Determining the Condition of Agricultural Soil Water Analisis Pola Hujan Bulanan Dengan Data Outgoing Longwave Radiation (OLR) Untuk Menentukan Kandungan Air Lahan Pertanian**

Khomarudin, M. Rokhis, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; ParwatidanWardin, Dalimunthe, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; June 2001; ISSN 0126-9754; Volume 3, No. 2, pp. 56-63; In Malay-Indonesian; Copyright; Avail: Issuing Activity

The rainfall is an important climate element for agriculture. The modelling for rainfall forecasting using OLR data can be used to make the monthly rainfall pattern at Indonesia. It is determined Oldeman climate type based on this pattern and calculated the condition of agricultural soil water. The analysis results indicate three types of rain pattern in Indonesia that is Equatorial, Monsoon and Local. The dry areas are East Java, Bali and Nusa Tenggara having water deficit more than six months (Oldeman Type E) and the wet areas are Sumatera, Kalimantan and Irian Jaya categorized to Oldeman type A-C1 having average water surplus above five months. The others are normal condition.

Author

*Agriculture; Long Wave Radiation; Rain; Soils*

**20020039289** Fleet Weather Central/Joint Typhoon Warning Center, FPO, San Francisco, CA USA

**1971 Annual Typhoon Report Annual Report**

Slusser, Richard C.; Nishimoto, Hiroshi; Jan. 1995; 322p; In English

Report No.(s): AD-A399631; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report is published annually and summarizes Western North Pacific Tropical Cyclones. Annex A summarizes tropical cyclones from 180 degrees eastward to the North American Coast, and Annex B summarizes tropical cyclones in the Bay of Bengal east of 90 degrees.

DTIC

*Typhoons; Tropical Regions*

**20020039290** Fleet Weather Central/Joint Typhoon Warning Center, FPO, San Francisco, CA USA

**1970 Annual Typhoon Report Annual Report**

Slusser, Richard C.; Kinney, John J.; Jan. 1995; 237p; In English

Report No.(s): AD-A399630; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report is published annually and summarizes Western North Pacific Tropical Cyclones. Annex A is added to summarize Tropical Cyclones from 180 degrees eastward to the North American Coast.

DTIC

*Typhoons; Tropical Regions*

**20020039291** Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center, Pearl Harbor, HI USA

**1980 Annual Typhoon Report Annual Report**

Tupaz, Jesus B.; Murray, Thomas R.; Diercks, John W.; Jan. 1995; 191p; In English

Report No.(s): AD-A399646; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Annual Typhoon Report summarizes the tropical cyclones occurring during 1980 in the western North Pacific, the Central North Pacific and the North Indian Oceans.

DTIC

*Typhoons; Tropical Regions*

**20020039292** Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center, Pearl Harbor, HI USA

**1981 Annual Typhoon Report Annual Report**

Tupaz, Jesus B.; Diercks, John W.; Morss, Dean A.; Jan. 1995; 203p; In English

Report No.(s): AD-A399645; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Annual Typhoon Report summarizes the tropical cyclones occurring during 1981 in the western North Pacific, the Central North Pacific and the North Indian Oceans.

DTIC

*Typhoons; Tropical Regions*

**20020039298** Lembaga Penerbangan dan Antariksa Nasional, Bidang Pemantauan Sumberdaya Alam dan Lingkungan, Jakarta, Indonesia

**Study of Air Temperature Spatial Distribution Change Caused by Land Cover Changes Kajian Perubahan Distribusi Spasial Suhu Udara Akibat Perubahan Penutup Lahan**

Adiningsih, Erna Sri, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Soenarmo, Sri Hartati, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Mujiasih, S., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; March 2001; ISSN 0126-9754; Volume 3, No. 1, pp. 29-44; In Malay-Indonesian; Original contains color illustrations; Copyright; Avail: Issuing Activity

Land cover change will cause change in energy balance, and finally will lead to air temperature change. Since detection of those changes is often difficult due to the lack of climatological stations at the surface, satellite technology becomes a good alternative for such purposes. This research was aimed to study the relation between land cover change and air temperature change. Bandung was chosen as a case study since its development rate was profound especially in suburban area. The data consisted of LANDSAT TM band 2, 4, and 5 for land cover change analysis, TM band 7 for temperature change analysis, and air temperature from 6 meteorological stations in Bandung. The data periods were 1994, 1996, and 1998, while field observation was conducted in 1998. The result shows that air temperature changed during the periods was affected by land cover change especially from vegetated area to settlement area. Settlement areas during 1994 - 1996 and 1996 - 1998 were increased by 0,68 % and 8,61 %, respectively. In the same periods, the temperature tended to increase. The area of surface temperature interval 27-28 C was 18,32% in 1994, 4,84% in 1996, and 19,69% in 1998.

Author

*Spatial Distribution; Climatology; Land Surface Temperature; Weather*

**20020039306** Fleet Weather Central/Joint Typhoon Warning Center, FPO, San Francisco, CA USA

**1963 Annual Typhoon Report Annual Report**

Cassidy, Richard M.; Lane, Roland C.; Jan. 1995; 210p; In English

Report No.(s): AD-A399604; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report is published annually and summarizes Western and Central North Pacific typhoons. During 1963, no typhoons or tropical storms were reported in the Central North Pacific.

DTIC

*Typhoons; Tropical Regions*

**20020039307** Fleet Weather Central/Joint Typhoon Warning Center, FPO, San Francisco, CA USA

**1966 Annual Typhoon Report Annual Report**

Steuckert, J. F.; Boyce, Robert E.; Jan. 1995; 263p; In English

Report No.(s): AD-A399611; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report is published annually and summarizes Western North Pacific Tropical Cyclones. Annex A is added to summarize Tropical Cyclones from 180 degrees eastward to the North American Coast.

DTIC

*Typhoons; Tropical Regions*

**20020039308** Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center, Pearl Harbor, HI USA

**1962 Annual Typhoon Report Annual Report**

Kotsch, William J.; Hutchinson, Leonard H.; Jan. 1995; 307p; In English

Report No.(s): AD-A399622; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report is published annually and summarizes Western and Central North Pacific typhoons. During 1962, no typhoons or tropical storms were reported in the Central North Pacific.

DTIC

*Typhoons; Tropical Regions*

**20020039309** Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center, Pearl Harbor, HI USA

**Annual Typhoon Report, 1961 Annual Report**

Kotsch, William J.; Hutchinson, Leonard H.; Jan. 1995; 255p; In English

Report No.(s): AD-A399621; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report is published annually and summarizes Western and Central North Pacific Typhoons. During 1961, no typhoons were reported in the Central North Pacific.

DTIC

*Typhoons; Pacific Ocean*

**20020039310** Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center, Pearl Harbor, HI USA

**1968 Annual Typhoon Report Annual Report**

Negele, J. H.; Roper, William D.; Jan. 1995; 334p; In English

Report No.(s): AD-A399620; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report is published annually and summarizes Western North Pacific Tropical Cyclones. Annex A is added to summarize Tropical Cyclones from 180 degrees eastward to the North American Coast.

DTIC

*Typhoons; Tropical Regions*

**20020039311** Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center, Pearl Harbor, HI USA

**1967 Annual Typhoon Report Annual Report**

Negele, J. H.; Roper, William D.; Jan. 1995; 261p; In English

Report No.(s): AD-A399619; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report is published annually and summarizes Western North Pacific Tropical Cyclones. Annex A is added to summarize Tropical Cyclones from 180 degrees eastward to the North American Coast.

DTIC

*Typhoons; Tropical Regions*

**20020039320** Lembaga Penerbangan dan Antariksa Nasional, Pusat Pemanfaatan Sains Atmosfer dan Iklim, Jakarta, Indonesia  
**Vegetation Index and Albedo Contribution to Surface Air Temperature in the West and Central Indonesian Region Based on NOAA Satellite Data** *Kontribusi Indeks Vegetasi dan Albedo Terhadap Temperatur Udara Permukaan di Wilayah Indonesia Data Satelit NOAA*

Lely, Q. A., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Teguh, H., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Rukmi, H., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Juniarti, V., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Dadang, S., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; March 2001; ISSN 0126-9754; Volume 3, No. 1, pp. 19-28; In Malay-Indonesian; Copyright; Avail: Issuing Activity

The surface air temperature variation influenced by the vegetation index and albedo was analyzed for West and Central Indonesia region by using NOAA-14 satellite data of June, July and August 1997 and 1998. The result shows that the decrease of the vegetation index caused the increase of the surface air temperature and the albedo. While the increase of the albedo caused the increase the surface air temperature. During this observation, in case of the value along equator of Surnatera the vegetation index increase by 3.3% whereas the surface air temperature and the albedo decrease by 0.1% and 0.2% respectively. While in case of along equator of Kalimantan the vegetation index decrease by 0.2% whereas the surface air temperature and the albedo increase by 1.5% and 0.1% respectively.

Author

*Albedo; NOAA 14 Satellite; Surface Temperature; Vegetative Index*

**20020039328** NASA Goddard Space Flight Center, Greenbelt, MD USA

**The Effect of Regional Climate Variability on Outbreak of Bartonellosis Epidemics in Peru**

Zhou, Jia-Yu, Maryland Univ. Baltimore County, USA; Lau, K.-M., NASA Goddard Space Flight Center, USA; Laughlin, Larry W., Uniformed Services Univ. of the Health Sciences, USA; Masuoka, Penny M., Uniformed Services Univ. of the Health Sciences, USA; Andre, Richard G., Uniformed Services Univ. of the Health Sciences, USA; Chamberlin, Judith, Uniformed Services Univ. of the Health Sciences, USA; Lawyer, Phillip, Uniformed Services Univ. of the Health Sciences, USA; [2001]; 12p; In English; Original contains color illustrations

Contract(s)/Grant(s): NOAA-NA-00ANRG0333; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Bartonellosis is a vector-borne, highly fatal, emerging infectious disease, which has been known in the Peruvian Andes since the early 1600s and has continued to be a problem in many mountain valleys in Peru and other Andean South American countries. The causative bacterium, *Bartonella bacilliformis* (Bb), is believed to be transmitted to humans by bites of the sand fly *Lutzomyia verrucarum*. According to available medical records, the transmission of infection often occurs in river valleys of the Andes Mountains at an altitude between 800 and 3500 meters above sea level. It shows a seasonal pattern, which usually begins to rise in December, peaks in February and March, and is at its lowest from July until November. The epidemics of bartonellosis also vary interannually, occurring every four to eight years, and appear to be associated with the El Nino cycle. In response to the National Oceanic and Atmospheric Administration (NOAA) announcement on climate variability and human health, which was constructed to stimulate integrated multidisciplinary research in the area of climate variability and health interactions, we have conducted a study to investigate the relationship between the El Nino induced regional climate variation and the outbreak of bartonellosis epidemics in Peru. Two test sites, Caraz and Cusco, were selected for this study. According to reports, Caraz has a long-standing history of endemic transmission and Cusco, which is located about five degrees poleward of Caraz, had no recorded epidemics until the most recent 1997/1998 El Nino event. The goal of this study is to clarify the relative importance of climatic risk factors for each area that could be predicted in advance, thus allowing implementation of cost-effective control measures, which would reduce disease morbidity and mortality.

Derived from text

*Andes Mountains (South America); Climate; El Nino; Infectious Diseases; Annual Variations*

**20020039632** NASA Goddard Space Flight Center, Greenbelt, MD USA

**A Two-Dimensional Variational Analysis Method for NSCAT Ambiguity Removal: Methodology, Sensitivity, and Tuning**

Hoffman, R. N., Atmospheric and Environmental Research, Inc., USA; Leidner, S. M., Atmospheric and Environmental Research, Inc., USA; Henderson, J. M., Atmospheric and Environmental Research, Inc., USA; Atlas, R., NASA Goddard Space Flight Center, USA; Ardizzone, J. V., General Sciences Corp., USA; Bloom, S. C., General Sciences Corp., USA; [2001]; 77p; In English; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In this study, we apply a two-dimensional variational analysis method (2d-VAR) to select a wind solution from NASA Scatterometer (NSCAT) ambiguous winds. 2d-VAR determines a "best" gridded surface wind analysis by minimizing a cost function. The cost function measures the misfit to the observations, the background, and the filtering and dynamical constraints. The ambiguity closest in direction to the minimizing analysis is selected. 2d-VAR method, sensitivity and numerical behavior are

described. 2d-VAR is compared to statistical interpolation (OI) by examining the response of both systems to a single ship observation and to a swath of unique scatterometer winds. 2d-VAR is used with both NSCAT ambiguities and NSCAT backscatter values. Results are roughly comparable. When the background field is poor, 2d-VAR ambiguity removal often selects low probability ambiguities. To avoid this behavior, an initial 2d-VAR analysis, using only the two most likely ambiguities, provides the first guess for an analysis using all the ambiguities or the backscatter data. 2d-VAR and median filter selected ambiguities usually agree. Both methods require horizontal consistency, so disagreements occur in clumps, or as linear features. In these cases, 2d-VAR ambiguities are often more meteorologically reasonable and more consistent with satellite imagery.

Author

*Two Dimensional Models; Variational Principles; Tuning; Scatterometers; Wind (Meteorology); Sensitivity Analysis*

**20020039702** Meteorological Satellite Center, Kiyose, Japan

**Monthly Report of the Meteorological Satellite Center: November 2001**

November 2001; In English; CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity

The CD-ROM concerning the November 2001 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.

Derived from text

*Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan*

**20020039792** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Gravitational Signal of Mass Redistribution Due to Interannual Meteorological Oscillations in Atmosphere and Ocean**

Chao, B. F., NASA Goddard Space Flight Center, USA; Au, A. Y., NASA Goddard Space Flight Center, USA; Johnson, T., Naval Observatory, USA; [2001]; 1p; In English; 26th European Geophysical Society Meeting, 25-30 Mar. 2001, Nice, France; Sponsored by European Geophysical Society, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

Interannual meteorological oscillations (ENSO, QBO, NAO, etc.) have demonstrable influences on Earth's rotation. Here we study their effects on global gravitational field, whose temporal variations are being studied using SLR (satellite laser ranging) data and in anticipation of the new space mission GRACE. The meteorological oscillation modes are identified using the EOF (empirical orthogonal function)/PC (principal component) decomposition of surface fields (in which we take care of issues associated with the area-weighting and non-zero mean). We examine two fields, one for the global surface pressure field for the atmosphere obtained from the NCEP reanalysis (for the past 40 years), one for the surface topography field for the ocean from the TOPEX/Poseidon (T/P) data (for the past 8 years). We use monthly maps, and remove the mean-monthly ("climatology") values from each grid point, hence focusing only on non-seasonal signals. The T/P data were first subject to a steric correction where the steric contribution to the ocean surface topography was removed according to output of the numerical POCM model. The respective atmospheric and oceanic contributions to the gravitational variation, in terms of harmonic Stokes coefficients, are then combined mode-by-mode. Since the T/P data already contain the oceanic response to overlying atmospheric pressure, no regards to the inverted-barometer behavior for the ocean need be considered. Results for the lowest-degree Stokes coefficients can then be compared with space geodetic observations including the Earth's rotation and the SLR data mentioned above, to identify the importance of each meteorological oscillations in gravitational variation signals.

Author

*Gravitational Fields; Meteorological Parameters; Temporal Distribution; Southern Oscillation; Pressure Distribution*

**20020039858** NASA Ames Research Center, Moffett Field, CA USA

**SUCCESS Evidence for Cirrus Cloud Ice Nucleation Mechanisms**

Jensen, Eric, NASA Ames Research Center, USA; [1997]; 1p; In English; 77th Annual Meeting of the American Meteorological Society, 3-6 Feb. 1997, Long Beach, CA, USA; Sponsored by American Meteorological Society, USA  
Contract(s)/Grant(s): RTOP 538-08-12-27; No Copyright; Avail: Issuing Activity; Abstract Only

During the SUCCESS mission, several measurements were made which should improve our understanding of ice nucleation processes in cirrus clouds. Temperature and water vapor concentration were made with a variety of instruments on the NASA DC-8. These observations should provide accurate upper tropospheric humidities. In particular, we will evaluate what humidities

are required for ice nucleation. Preliminary results suggest that substantial supersaturations frequently exist in the upper troposphere. The leading-edge region of wave-clouds (where ice nucleation occurs) was sampled extensively at temperatures near -40 and -60C. These observations should give precise information about conditions required for ice nucleation. In addition, we will relate the observed aerosol composition and size distributions to the ice formation observed to evaluate the role of soot or mineral particles on ice nucleation. As an alternative technique for determining what particles act as ice nuclei, numerous samples of aerosols inside ice crystals were taken. In some cases, large numbers of aerosols were detected in each crystal, indicating that efficient scavenging occurred. Analysis of aerosols in ice crystals when only one particle per crystal was detected should help with the ice nucleation issue. Direct measurements of the ice nucleating activity of ambient aerosols drawn into airborne cloud chambers were also made. Finally, measurements of aerosols and ice crystals in contrails should indicate whether aircraft exhaust soot particles are effective ice nuclei.

Author

*Cirrus Clouds; Ice; Ice Nuclei; Nucleation*

**20020039956** NASA Goddard Space Flight Center, Greenbelt, MD USA

**On Quality Control Procedures Being Adopted for TRMM LBA and KWAJEX Soundings Data Sets**

Roy, B., Science Systems and Applications, Inc., USA; Halverson, Jeffrey B., NASA Goddard Space Flight Center, USA; [2001]; 6p; In English; AMS Symposium on Observations, Data Assimilation, and Probabilistic Prediction, 13-17 Jan. 2002, Orlando, FL, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During NASA's Tropical Rainfall Measuring Mission (TRMM) field campaigns Large Scale Biosphere Atmosphere (LBA) held in Amazonia (Brazil) in the period January- February, 1999, and the Kwajalein Experiment (KWAJEX) held in the Republic of Marshall Islands in the period between August-September, 1999, extensive radiosonde observations (raob) were collected using VIZ and Vaisala sondes which have different response characteristics. In all, 320 raob for LBA and 972 fixed raob for KWAJEX have been obtained and are being processed. Most atmospheric sensible heat source (Q1) and apparent moisture sink (Q2) budget studies are based on sounding data, and the accuracy of the raob is important especially in regions of deep moist convection. A data quality control (QC) project has been initiated at GSFC by the principal investigator (JBH), and this paper addresses some of the quantitative findings for the level I and II QC procedures. Based on these quantitative assessment of sensor (or system) biases associated with each type of sonde, the initial data repair work will be started. Evidence of moisture biases between the two different sondes (VIZ and Vaisala) has been shown earlier by Halverson et al. (2000). Vaisala humidity sensors are found to have a low-level dry bias in the boundary layer, whereas above 600 mb the VIZ sensor tends to register a dryer atmosphere. All raob data were subjected to a limit check based on an algorithm already well tested for the raob data obtained during the Tropical Ocean Global Atmosphere (TOGA-COARE).

Derived from text

*Quality Control; Tropical Regions; Moisture; Humidity; Heat Sources; Boundary Layers; Air Water Interactions*

**20020039957** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Simulation of TRMM Microwave Imager Brightness Temperature using Precipitation Radar Reflectivity for Convective and Stratiform Rain Areas over Land**

Prabhakara, C., NASA Goddard Space Flight Center, USA; Iacovazzi, R., Jr., Science Systems and Applications, Inc., USA; Yoo, J.-M., Ewha Woman's Univ., Korea, Republic of; February 2002; 64p; In English

Report No.(s): NASA/TM-2002-210000; NAS 1.15:210000; Rept-2002-01042-0; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Rain is highly variable in space and time. In order to measure rainfall over global land with satellites, we need observations with very high spatial resolution and frequency in time. On board the Tropical Rainfall Measuring Mission (TRMM) satellite, the Precipitation Radar (PR) and Microwave Imager (TMI) are flown together for the purpose of estimating rain rate. The basic method to estimate rain from PR has been developed over the past several decades. On the other hand, the TMI method of rain estimation is still in the state development, particularly over land. The objective of this technical memorandum is to develop a theoretical framework that helps relate the observations made by these two instruments. The principle result of this study is that in order to match the PR observations with the TMI observations in convective rain areas, a mixed layer of graupel and supercooled water drops above the freezing level is needed. On the other hand, to match these observations in the stratiform region, a layer of snowflakes with appropriate densities above the freezing level, and a melting layer below the freezing level, are needed. This understanding can lead to a robust rainfall estimation technique from the microwave radiometer observations.

Author

*Estimating; Graupel; Water; Simulation; Precipitation (Meteorology); Microwave Imagery; Metrology; Rain Forests; Rain*

**20020040050** Department of Defense, Office of the Inspector General, Arlington, VA USA

**Defense Weather Program: Meteorological and Oceanographic Support from Continental USA-Based Support Centers**

Steensma, David K.; Feb. 19, 2002; 89p; In English

Report No.(s): AD-A399293; IG/DOD-D-2002-052; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report is the sixth in a series evaluating the effectiveness and efficiency of DoD meteorological and oceanographic (METOC) support provided by the Military Departments to DoD and other governmental agencies.

DTIC

*Meteorology; Oceanography*

**20020040053** Analytic Sciences Corp., Reading, MA USA

**Night Vision Goggles Operations Weather Software (NOWS)**

Bensinger, Richard J.; Gouveia, Melanie J.; Sep. 14, 1999; 24p; In English

Contract(s)/Grant(s): F19628-94-C-0201; Proj-2688

Report No.(s): AD-A399289; AFRL-VS-TR-2001-1508; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes progress on the development of NYG Operations Weather Software (NOWS) from September 1997 through August 1998. NOWS is designed for use by DoD meteorologists to support forces performing covert operations using NVGs. The types of missions that are supported include helicopter refueling, target acquisition/detection, take-off and landing, identification of pickup/drop zones, and search and rescue. NYG performance predictions are made for specified missions and forecasted local weather conditions. NOWS also provides solar and lunar ephemeris information for a series of times or dates at a user-specified location. NOWS is being developed incrementally to include state-of-the-art physical models, a modern graphical user interface, and access to geographic and meteorological databases to provide accurate results, maximize usability, and minimize the amount of input data that must be entered manually by a user. This report describes progress made in the areas of NOWS system design, user interface, physical models, and model assessment.

DTIC

*Computer Programs; Weather; Goggles; Meteorology; Night Vision; Targets*

**20020040080** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Laser Transmission Through Simulated Cirrus Clouds**

Kolb, Ila L.; Jan. 2001; 88p; In English

Report No.(s): AD-A399376; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Since approximately 20% of the globe is covered with cirrus clouds at any given time, it is clear that any airborne or spaceborne system using a laser will intercept cirrus clouds at some point. Cirrus clouds contain a very complex microphysical structure that will affect laser power by scattering and reflecting it away from the intended target, thus reducing efficiency and possibly even making it ineffective. Using two thin cirrus laser transmission models, a single homogeneous cloud layer model and a multiple cloud layer model, laser transmission profiles are generated from a simulated cirrus cloud case created by the RAMS model. Sensitivity studies are performed on the laser transmission model to examine the effects of aerosols and water vapor, ice crystal orientation, multiple scattering contributions, and the differences between the single and multiple layer models. Different parts of the RAMS simulated cloud are examined as well as the development of a particular cloud feature. The two different laser transmission models are compared against each other for a variety of different cirrus cloud conditions within the simulated case. Optical depth is a cloud variable that is fairly well measured using remote sensing techniques and airborne lidar. Average optical depth is examined as a viable parameter to indicate the likely transmission through a cloud.

DTIC

*Simulation; Cirrus Clouds; Transmittance; Lasers; Optical Thickness; Optical Radar; Aerosols*

**20020040109** Texas A&M Univ., College Station, TX USA

**Initialization of Clouds in the PSU/NCAR Mesoscale Model Using the Air Force's Real-Time Nephanalysis**

Cantrell, Louis E., Jr.; May 2002; 254p; In English; Original contains color images

Report No.(s): AD-A399286; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Modern operational mesoscale numerical weather prediction models have the potential to forecast cloud structure and distribution more accurately through cloud physical initialization than through simple cloud cover estimation with synoptic-scale data or through dynamic initialization. In an attempt to produce a better cloud forecast and to reduce model spin-up time, a technique is developed that converts the Air Force's Real-Time Nephanalysis (RTNEPH) into cloud species mixing ratios that are used to initialize the PSU/NCAR (Pennsylvania State University/ National Center for Atmospheric Research) Fifth-Generation Mesoscale Model (MM5). The cloud analysis and the model are chosen to simulate the operational modeling

environment at Air Force Weather Agency (AFWA). MM5 is used to forecast clouds evolving around a stationary front along the Texas coast of the Gulf of Mexico from 13 September 2000 through 15 September 2000. A cloud physical parameterization scheme currently in use in the Eta model provides the framework for converting RTNeph clouds to data that can be used to initialize MM5. Modifications to this scheme make it purely diagnostic and account for the higher resolution grid to which it is applied. The technique used to initialize clouds is called the Cloud Initialization Scheme (CIS). Cloud variables analyzed by CIS are used to examine how sensitive MM5 forecast cloud distributions are to the initial distribution of clouds. Analyzed cloud is also compared to MM5 forecast clouds to determine if cloud forecasts are improved using this technique, and to determine if model spin-up is reduced. Results indicate dramatic improvement in reducing spin-up time but only slight improvement in forecast accuracy. Large differences exist between the distribution characteristics of the analysis and of the forecast.

DTIC

*Atmospheric Models; Mesometeorology; Clouds (Meteorology); Numerical Weather Forecasting*

**20020040403** Naval Oceanography Command Center/Joint Typhoon Warning Center, FPO San Francisco 96630, FPO San Francisco, CA USA

**1988 Annual Tropical Cyclone Report Annual Report**

Plante, Robert J.; McMorrow, Daniel J.; Jan. 01, 1995; 230p; In English

Report No.(s): AD-A399462; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The Annual Tropical Cyclone Report summarizes the tropical cyclones occurring during 1988 in the western North Pacific, the Central North Pacific and the North Indian Oceans.

DTIC

*Tropical Storms; Cyclones*

**20020040405** Naval Oceanography Command Center/Joint Typhoon Warning Center, FPO San Francisco 96630, FPO San Francisco, CA USA

**1989 Annual Tropical Cyclone Report Annual Report, Jan.-Dec. 1989**

Plante, Robert J.; Guard, Charles P.; Jan. 01, 1995; 267p; In English

Report No.(s): AD-A399460; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Annual publication summarizing tropical cyclone activity in the Western North Pacific, Bay of Bengal, Arabian Sea, Western South Pacific and South Indian Oceans. A best track is provided for each significant tropical cyclone. A brief narrative is given for all tropical cyclones in the western North Pacific and North Indian Oceans. All reconnaissance and fix data used to construct the best tracks are provided, upon request, on floppy diskettes. Forecast verification data and statistics for the Joint Typhoon Warning Center (JTWC) are submitted.

DTIC

*Tropical Storms; Typhoons; Arabian Sea*

**20020040789** Naval Oceanography Command Center/Joint Typhoon Warning Center, FPO San Francisco 96630, FPO San Francisco, CA USA

**1987 Annual Tropical Cyclone Report Annual Report, Jan. 1987-Dec. 1987**

Hoffman, Carl W.; Patterson, Vernon G.; McMorrow, Daniel J.; Jan. 1987; 226p; In English

Report No.(s): AD-A399484; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Annual publication summarizing tropical cyclone activity in the Western North Pacific, Bay of Bengal and the Arabian Sea, and South Pacific and South Indian oceans. A best track is provided for each significant tropical cyclone. A brief narrative is given for all typhoons and selected tropical cyclones in the Western North Pacific and North Indian Ocean. All reconnaissance data used to construct the best tracks are provided. Forecast verification data and statistics for the Joint Typhoon Warning Center (JTWC) are submitted.

DTIC

*Cyclones; Tropical Storms; Forecasting*

**20020040791** Aerospace Corp., Technology Operations, El Segundo, CA USA

**Wavelength Dependence of Cirrus Optical Depth**

Lynch, D. K.; Mazuk, S. M.; Dec. 10, 2001; 14p; In English

Contract(s)/Grant(s): F04701-00-C-0009

Report No.(s): AD-A399481; AR-TR-2001(8570)-1; SMC-TR-02-10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The normalized wavelength-dependent optical depth of the two cirrus cloud models resident in MODTRAN 4 ('standard' and 'subvisual') is computed along with the scattering and absorption components. The wavelength-dependent asymmetry parameter is also calculated. We find that the optical depths as a function of wavelength are significantly different for the two models, most of which is attributable to particle size effects.

DTIC

*Optical Properties; Cirrus Clouds; Optical Thickness; Wavelengths; Space Perception*

**20020040793** Fleet Weather Central/Joint Typhoon Warning Center, FPO, San Francisco, CA USA

**1964 Annual Typhoon Report Annual Report**

Bird, H. V.; Cassidy, Richard M.; Lame, Roland C.; Jan. 1995; 254p; In English

Report No.(s): AD-A399605; No Copyright; Avail: Defense Technical Information Center (DTIC); Hardcopy only

This report is published annually and summarizes Western and Central North Pacific typhoons. During 1964, no typhoons or tropical storms were reported in the Central North Pacific.

DTIC

*Cyclones; Typhoons; Tropical Storms*

**20020040794** Fleet Weather Central/Joint Typhoon Warning Center, FPO, San Francisco, CA USA

**1965 Annual Typhoon Report Annual Report**

Steuckert, J. F.; Boyce, Robert E.; Jan. 1995; 256p; In English

Report No.(s): AD-A399609; No Copyright; Avail: Defense Technical Information Center (DTIC); Hardcopy Only

This report is published annually and summarizes Western North Pacific Tropical Cyclones. Effective this year, Ann= A is added to summarize Tropical Cyclones from 180 degrees eastward to the North American Coast.

DTIC

*Tropical Storms; Cyclones; Typhoons*

**20020040796** Fleet Weather Central/Joint Typhoon Warning Center, FPO, San Francisco, CA USA

**Typhoon Report Annual Report, 1974**

Hamilton, Glenn D.; Atkinson, Gary D.; Jan. 1995; 125p; In English

Report No.(s): AD-A399633; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The body of this report summarizes Western North Pacific Tropical Cyclones. Annex A summarizes tropical cyclones from 180 degrees eastward to 140 degrees west, and Annex B summarizes tropical cyclones in the Bay of Bengal. The U.S. National Weather Service publishes summaries of eastern North Pacific tropical cyclones in the Monthly Weather Review, the Mariners Weather Log, and Pilot charts.

DTIC

*Typhoons; Meteorological Parameters; Pacific Ocean*

**20020040797** Fleet Weather Central/Joint Typhoon Warning Center, FPO, San Francisco, CA USA

**Typhoon Report Annual Report, 1972**

Buckmaster, Albert T.; Nishimoto, Hiroshi; Jan. 1995; 140p; In English

Report No.(s): AD-A399632; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The body of this annual report summarizes Western North Pacific Tropical Cyclones. Annex A summarizes tropical cyclones from 180 degrees eastward to the North American Coast, and Annex B summarizes tropical cyclones in the Bay of Bengal east of 90 degrees.

DTIC

*Typhoons; Hurricanes; Meteorological Parameters*

**20020040802** Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center, Pearl Harbor, HI USA

**Tropical Cyclone Report Annual Report, 1999**

McPherson, Terry; Stapler, Wendell; Jan. 1999; 215p; In English; Original contains color images

Report No.(s): AD-A399585; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The mission of the Joint Typhoon Warning Center is multi-faceted and includes: Continuous monitoring of all tropical weather activity in the Northern and Southern Hemispheres, from 180 degrees longitude westward to the east coast of Africa, and the prompt issuance of appropriate advisories and alerts when tropical cyclone development is anticipated.

DTIC

*Cyclones; Storms (Meteorology); Warning Systems; Tropical Regions*

**20020040807** Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center, Pearl Harbor, HI USA

**Tropical Cyclone Report Annual Report, 1998**

Aldinger, W. T.; Stapler, Wendell; Jan. 1998; 222p; In English; Original contains color images

Report No.(s): AD-A399580; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The mission of the Joint Typhoon Warning Center is multi-faceted and includes: Continuous monitoring of all tropical weather activity in the Northern and Southern Hemispheres, from 180 degrees longitude westward to the east coast of Africa, and the prompt issuance of appropriate advisories and alerts when tropical cyclone development is anticipated.

DTIC

*Cyclones; Tropical Regions; Tropical Meteorology; Warning Systems*

**20020040862** Naval Oceanography Command Center/Joint Typhoon Warning Center, FPO San Francisco 96630, FPO San Francisco, CA USA

**1992 Annual Tropical Cyclone Report Annual Report, Jan.-Dec. 1992**

Mautner, Donald A.; Guard, Charles P.; Jan. 1992; 280p; In English

Report No.(s): AD-A399535; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The mission of the Joint Typhoon Warning Center is multi-faceted and includes: Continuous monitoring of all tropical weather activity in the Northern and Southern Hemispheres, from 180 degrees longitude westward to the east coast of Africa, and the prompt issuance of appropriate advisories and alerts when tropical cyclone development is anticipated.

DTIC

*Typhoons; Tropical Regions*

**20020040864** Naval Oceanography Command Center/Joint Typhoon Warning Center, FPO San Francisco 96630, FPO San Francisco, CA USA

**1991 Annual Tropical Cyclone Report Annual Report, Jan. 1991-Dec. 1991**

Rudolph, Dieter K.; Guard, Charles P.; Jan. 1995; 248p; In English

Report No.(s): AD-A399542; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Annual publication summarizing tropical cyclone activity in the Western North Pacific, Bay of Bengal, Arabian Sea, Western South Pacific and South Indian Oceans. A best track is provided for each significant tropical cyclone. A brief narrative is given for all tropical cyclones in the Western North Pacific and North Indian Oceans. All fix data used to construct the best tracks are provided, upon request, on diskettes, forecast verification data and statistics for the joint typhoon warning center (JTWC) are submitted.

DTIC

*Cyclones; Tropical Regions*

**20020040867** Science and Technology Corp., Hampton, VA USA

**Development, Implementation, and Analysis of an Environmental Simulation Information Reference Library and Archive (ESIRLA) Final Report, 15 Nov. 1994-14 Nov 1997**

Burgeson, John; Dec. 1997; 10p; In English

Contract(s)/Grant(s): F19828-95-C-0005

Report No.(s): AD-A399594; STC-TR-3162; AFRL-VS-TR-2001-1667; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

As part of the Environmental Effects for Distributed Interactive Simulations (E2DIS) Project, Science and Technology Corp. (STC) conducted a survey of the DoD environmental science community to identify cloud modeling and other environmental capabilities that support or could potentially support military modeling and simulation (M&S) efforts. STC also surveyed the DoD M&S community to determine its requirements for environmental data and models of environmental effects. The resulting data were stored in a PC-based relational database. STC organized and conducted two tri-service Cloud Impacts on DoD operations and Systems (CIDOS) conferences to facilitate the exchange of information on cloud modeling techniques and applications for

the benefit of the DoD environmental science community. STC determined the detailed requirements for weather effects products and decision aids for specific Air Force operational electro-optical systems.

DTIC

*Clouds; Environment Models; Relational Data Bases; Decision Support Systems; Electro-Optics; Environment Effects; Environment Simulation*

**20020040888** Naval Oceanography Command Center/Joint Typhoon Warning Center, FPO San Francisco 96630, FPO San Francisco, CA USA

**1983 Annual Tropical Cyclone Report Annual Report**

Hinman, Kendall G., Jr.; Morss, Dean A.; McLawhorn, David W.; Jan. 1983; 203p; In English  
Report No.(s): AD-A399487; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The Annual Tropical Cyclone Report summarizes the tropical cyclones occurring during 1983 in the western North Pacific, the Central North Pacific and the North Indian Oceans.

DTIC

*Tropical Storms; Cyclones; Weather Forecasting*

**20020040889** Naval Research Lab., Ocean Dynamics and Prediction Branch, Stennis Space Center, MS USA

**A Review of U.S. Navy Atmospheric Model Products in the Arabian Gulf - An Examination of NORAPS and COAMPS**

Smedstad, Lucy F.; Blain, Cheryl A.; Dec. 28, 2001; 72p; In English; Original contains color images

Report No.(s): AD-A399510; NRL/FR/7320--01-9978; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Recent U.S. Navy operational atmospheric products, the Navy Operational Regional Atmospheric Prediction System (NORAPS) and the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS), are reviewed relative to the Arabian Gulf waters. Only the most recent complete calendar years of each product are considered. The structure and description of five products (air temperature, heat flux, surface pressure, wind speed, and wind stress) relevant to the Naval Research Laboratory's coastal modeling efforts for the Arabian Gulf are explained. A detailed discussion of the dynamics and variability observed in the annual and seasonal mean fields is presented. Within this context, the NORAPS and COAMPS products are contrasted. Observations for each of the five atmospheric quantities have been identified in the literature. RMS errors and correlations are computed from comparisons between the Navy atmospheric basin-wide mean products and the observed data. These comparisons provide an avenue to assess the quality of the atmospheric data products with respect to the observed environment. Good agreement between the atmospheric data products and the open literature is found for scalar quantities such as air temperature and surface pressure. Wind speeds and wind stresses tend to be underpredicted with respect to the Winter Shamal though no definitive conclusions can be reached about overall quality due to the high degree of variability in the observed wind sources. On the contrary, heat flux products are determined to be quite poor, at least over Arabian Gulf waters when compared to available observations. Lastly, the preprocessing of the atmospheric products prior to implementation in an oceanic modeling context is included as an appendix.

DTIC

*Air Water Interactions; Atmospheric Models; Mesoscale Phenomena; Persian Gulf*

## 51

### LIFE SCIENCES (GENERAL)

*Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.*

**20020039300** Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan

**C7-Substituted ES TRA-1,3,5(10)-Trines - Synthesis: An Overview**

Thiemann, Thies, Kyushu Univ., Japan; Imai, Masao, Kyushu Univ., Japan; Shima, Yuji, Kyushu Univ., Japan; Watanabe, Masataka, Kyushu Univ., Japan; Mataka, Shuntaro, Kyushu Univ., Japan; MeloeSilva, M. Christina, Instituto Tecnologico e Nuclear, Portugal; The Reports of Institute of Advanced Material Study, Kyushu University; 2001; ISSN 0914-3793; Volume 15, No. 2, pp. 197-209; In English; Copyright; Avail: Issuing Activity

This document gives a comprehensive review of preparations of C7-substituted estranes. In recent times the study of estrogens and antiestrogens, both naturally occurring and synthetic, has gained importance in such diverse but interlinked fields as the development of radiodiagnostics for breast cancer, the advancement of both chemical cancer therapy and hormone

replacement therapy as well as the systematic study of the action of environmental hormones on the human endocrinal system and their effect on wildlife. Although compounds that possess estrogenic or antiestrogenic character can be of a variety of structures, the natural human estrogen is the steroid *estra-3,7 beta-diol*. In the last three decades a lot of research has been devoted to the development of new steroids with applications in the fields mentioned above. Especially, C7-substituted steroids have been at the forefront of that development. The following review focuses on the synthesis of C-7 substituted estrane derivatives.

Author

*Estrogens; Steroids; Molecular Structure*

**20020039538** NASA Ames Research Center, Moffett Field, CA USA

**Effect of Environmental Enrichment on Singly- and Group-Housed Squirrel Monkeys**

Spring, Sarah E., NASA Ames Research Center, USA; Clifford, James O., Lockheed Martin Engineering and Science Services, USA; Tomko, David L., NASA Ames Research Center, USA; [1996]; 17p; In English

Contract(s)/Grant(s): RTOP 199-16-12-17; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nonhuman primates display an interest in novel places, habituate to new situations, and spend most of their daily activity in the wild in large groups engaging in feeding behaviors. Captivity changes these behaviors, and disrupts normal social hierarchies. In captivity, animals may exhibit stereotypical behaviors which are thought to indicate decreased psychological well-being (PWB). If an animal's behaviors can be made to approach those seen in the wild, and stereotypical behaviors are minimal it is assumed that PWB is adequate. Environmental enrichment (EE) devices have been used to address the Animal Welfare Act's requirement that the PWB of captive nonhuman primates be considered. The purpose of the present study was to examine whether various EE devices improve the PWB of captive squirrel monkeys. The present study used behavioral observation to quantify the effectiveness of several EE devices in reducing stereotypical behaviors in squirrel monkeys housed singly or in groups. Results showed that the EE devices used did not affect the expression of normal or stereotypical behaviors, but that the type of housing did.

Author

*Monkeys; Social Factors; Psychological Effects*

**20020039546** Massachusetts Inst. of Tech., Dept. of Earth, Atmospheric and Planetary Sciences, Cambridge, MA USA

**Early Precambrian Carbonate and Evapolite Sediments: Constraints on Environmental and Biological Evolution *Final Report, 1 Oct. 1997 - 30 Sep. 2000***

Grotzinger, John P., Massachusetts Inst. of Tech., USA; [2002]; 4p; In English

Contract(s)/Grant(s): NAG5-6722

Report No.(s): MIT-004743-001; MIT-6693500; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The work accomplished under NASA Grant NAG5-6722 was very successful. Our lab was able to document the occurrence and distribution of evaporite-to-carbonate transitions in several basins during Precambrian time, to help constrain the long-term chemical evolution of seawater.

Author

*Biological Evolution; Carbonates; Chemical Evolution; Sea Water*

**20020039641** NASA Ames Research Center, Moffett Field, CA USA

**Significance of Plant Root Microorganisms in Reclaiming Water in CELSS**

Bubenheim, David L., NASA Ames Research Center, USA; Greene, Catherine, Lockheed Martin Engineering and Sciences Co., USA; Wignarajah, Kanapathipillai, Lockheed Martin Engineering and Sciences Co., USA; [1996]; 1p; In English; 31st COSPAR Scientific Assembly, 14-21 Jul. 1996, Birmingham, UK; Sponsored by Committee on Space Research, Unknown

Contract(s)/Grant(s): RTOP 199-61-62; No Copyright; Avail: Issuing Activity; Abstract Only

Since many microorganisms demonstrate the ability to quickly break down complex mixtures of waste and environmental contaminants, examining their potential use for water recycling in a closed environment is appealing. Water contributes approximately 90 percent of the life sustaining provisions in a human space habitat. Nearly half of the daily water requirements will be used for personal hygiene and dish washing. The primary contaminants of the used "gray" water will be the cleansing agents or soaps used to carry out these functions. Reclaiming water from the gray water waste streams is one goal of the NASA program, Controlled Ecological Life Support Systems (CELSS). The microorganisms of plant roots are well documented to be of a beneficial effect to promote plant growth. Most plants exhibit a range of bacteria and fungi which can be highly plant-specific. In our investigations with lettuce grown in hydroponic culture, we identified a microflora of normal rhizosphere. When the roots were exposed to an anionic surfactant, the species diversity changed, based on morphological characteristics, with the numbers of species being reduced from 7 to 2 after 48 hours of exposure. In addition, the species that became dominant in the presence

of the anionic surfactant also demonstrated a dramatic increase in population density which corresponded to the degradation of the surfactant in the root zone. The potential for using these or other rhizosphere bacteria as a primary or secondary waste processor is promising, but a number of issues still warrant investigation; these include but are not limited to: (1) the full identification of the microbes, (2) the classes of surfactants the microbes will degrade, (3) the environmental conditions required for optimal processing efficiency and (4) the ability of transferring the microbes to a non-living solid matrix such as a bioreactor.

Author

*Microorganisms; Reclamation; Waste Water; Bioreactors; Recycling; Contaminants*

**20020039851** NASA Ames Research Center, Moffett Field, CA USA

**Plasma Hormone Concentrations in Monkeys after Spaceflight**

Grindeland, Richard E., NASA Ames Research Center, USA; Mukku, V. R.; Dotsenko, R.; Gosselink, K. L.; Bigbee, A. J.; Helwig, D.; [1997]; 1p; In English; FASEB Conference, 6-9 Apr. 1997, New Orleans, LA, USA; Sponsored by Federation of American Societies for Experimental Biology, USA

Contract(s)/Grant(s): RTOP 199-26-09-12; No Copyright; Avail: Issuing Activity; Abstract Only

The aim of this study was to determine the effects of a 12.5 day spaceflight on the endocrine status of Rhesus monkeys. Male monkeys (three to four years old; 4 kg) were adapted to chair restraint and trained for 20 months. Blood samples were obtained from four control (C) and two flight (F) monkeys preflight (PF), post-flight (Recovery-R; days 0, 3, 11, and 17), and before and after a mission length simulation (S). Cortisol, T4, T3, testosterone (T), and IGF-1 were measured by RIA (radioimmunoassay). Growth hormone (GH) was measured by an in vitro bioassay. Cortisol (16-34 ug/dl), T4 (3.9-7.4 ug/dl), and T (0.2-0.4 mg/ml) did not differ between F and C or between PF, R, and S samples. The low T values reflect the immaturity of the animals. In F, T3 fell from C levels of 208 +/- 4 ng/dl to 44 on R+0 and 150 on R+3, then returned to C. F showed a 55% decrease in GH at R+0 and decreases of 93, 89, and 80%, respectively, at R+3, 11, and 17. IGF-1 decreased from PF levels of 675 ng/ml to 365 (R+0) and 243 (R+3), but returned to C at R+11. GH and IGF-1 levels before and after S did not differ from each other or from C. The cause of the transitory decrease in T3 is unknown. The suppressed GH levels for 17 days after flight may reflect reduced proprioceptive input during flight. The faster recovery of IGF-1 suggests that factors other than reduced GH secretion are involved.

Author

*Blood Plasma; Endocrine Systems; Monkeys; Pituitary Hormones; Physiological Effects; Space Flight*

**20020039915** Fox Chase Cancer Center, Philadelphia, PA USA

**Susceptibility to Breast Cancer in CHK2 Mutation Carriers Annual Report, 30 Sep. 2000-30 Sep 2001**

Godwin, Andrew K.; Oct. 2001; 10p; In English

Contract(s)/Grant(s): DAMD17-00-1-0621

Report No.(s): AD-A399192; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Familial breast cancer accounts for 15 to 35% of all breast cancers. Mutations in a number of genes are now known to cause susceptibility to breast cancer; the most notorious are the BRCA1 and BRCA2 genes. However, it has become evident that not all (and not even the majority) of familial breast cancer families can be attributed to mutations in BRCA1 and BRCA2. In a recent study by the Breast Cancer Linkage Consortium, only one third of families with four or five cases of female breast cancer and no cases of ovarian cancer carry mutations in either BRCA1 or BRCA2. Because smaller familial clusters are much more common than families with large numbers of cases, the indication from these and other studies is that a substantial proportion of familial clustering is not accounted for by mutations in BRCA1 and BRCA2; therefore, there is a great need to discover other genes that contribute to this disease. Recently, it was reported that germline CHK2 mutations were found in two families with Li-Fraumeni syndrome and a third case with multiple primary cancers. The two families with Li-Fraumeni syndrome had diverse cancers, including early-onset breast cancers at ages 37, 41, and 45 years. The third proband developed breast cancer at age 47, malignant melanoma at 53 and primary lung cancer at 58, but had no family history of malignancies.

DTIC

*Genetics; Cancer; Mammary Glands; Heredity*

**20020039916** Massachusetts General Hospital, Boston, MA USA

**Utilization of a NF2-Mutant Mouse Strain to Investigate the Cellular and Molecular Function of the NF2 Tumor Suppressor, Merlin Annual Report, 15 Sep. 2000-14 Sep 2001**

McClatchey, Andrea I.; Oct. 2001; 18p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9495

Report No.(s): AD-A399194; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Neurofibromatosis type 2 (NF2) is a familial cancer syndrome that features the development of nervous system tumors. The NF2-encoded protein, merlin, localizes to the membrane-cytoskeleton interface, raising the intriguing question of how a protein that occupies such a physical niche controls cell proliferation. To generate an animal model for NF2 and to build the foundation for delineating the molecular function of merlin, we established a NF2-mutant mouse strain through genetic engineering. NF2 +/- mice develop a spectrum of tumors that is distinct from that of their human counterparts, including osteosarcomas and hepatocellular carcinomas, which exhibit loss of the wild-type NF2 allele.

DTIC

*Cells (Biology); Heredity; Cancer; Nervous System*

**20020040000** Children's Hospital, Parramatta, Australia

**Profile of the Neurofibromatosis Type 1 (NF1) Phenotype: Natural History, Neuropsychological and Psychosocial Aspects**  
**Annual Report, 1 Sep. 2000-31 Aug. 2001**

North, Kathryn; Sep. 2001; 12p; In English

Contract(s)/Grant(s): DAAD17-00-1-0534

Report No.(s): AD-A399153; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The natural history of both cognitive functioning and T2-hyperintensities is being examined in a longitudinal study of a cohort of 32 patients with NF1 and 11 controls. Follow-up neuropsychological assessments and cranial MRIs were performed after an eight-year period. Preliminary data analysis suggests that there is no improvement in cognitive function over time. MRI T2-hyperintensities decrease in size, intensity and number over time. However lesions in the basal ganglia behave differently from lesions in the cortex and brainstem, suggesting different underlying pathogenetic mechanisms. The timing of the MRI scan appears important in terms of its ability to predict cognitive deficits. In addition, we are conducting a comprehensive neuropsychological study of a cohort of 80 children with NF1 and 50 sibling controls. Patient ascertainment and testing is still in progress. These children (8-16 years) will undergo intensive cognitive assessments and MRIs. The relationship between T2-hyperintensities on cranial MRI and neuropsychological functioning will be examined by determining whether the number, size, or sites of these lesions are predictive of general or specific neuropsychological deficits. A multicenter study is also being conducted to characterize the distribution of IQ scores in a large international cohort of patients with NF1 and to determine whether any clinical or demographic variables are associated with lowering of IQ.

DTIC

*Lesions; Neurology; Psychology*

**20020040001** British Columbia Univ., Vancouver, British Columbia Canada

**Statistical Methods for Analysis of NF Clinical Data** *Annual Report*

Joe, Harry; Aug. 2001; 53p; In English

Contract(s)/Grant(s): DAMD17-00-1-0546

Report No.(s): AD-A399154; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This project describes research in statistical methods that would be useful for statistical modelling and analysis of clinical data from NF1 and NF2 subjects. The statistical methods are classified into the areas: (1) estimation of familial correlation for different types of data; and (2) assessment of multi-hit mutation models for incidence of tumours. Some of the statistical methods to be developed are either new or partly new and require further research for computer software implementation. One goal of the project is to produce a software package for familial data analysis for different types of data such as binary, count, censored survival data.

DTIC

*Applications Programs (Computers); Computer Programs; Statistical Analysis; Data Processing; Clinical Medicine*

**20020040002** Washington Univ., Dept. of Medicinal Chemistry, Seattle, WA USA

**Simulation of Protein and Peptide-Based Biomaterials** *Final Report, 1 Jan. 1999-31 Dec. 2001*

Daggett, Valerie; Feb. 13, 2002; 5p; In English

Contract(s)/Grant(s): NOOO14-99-1-0245

Report No.(s): AD-A399142; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall goal of the proposed research is to pursue realistic molecular modeling studies of the stability, dynamics, structure, function, and folding of proteins and protein-based biomaterials in solution. Simulations of elastin-based polymers will investigate the driving forces and mechanism for the unusual temperature-dependent conformational changes, knowledge that will assist in redesign of this system for specific applications and the design of other such molecules. Studies of the stabilities of cyclic peptides and their multimers (nanotubes) to both environment and peptide substitutions will be addressed, as well as their

mechanism of transport, selectivity, and gating. Methods are being developed for identifying and optimizing small, robust scaffolds for use as novel receptors, or biosensors. Functional optimization (typically binding) will also be explored.

DTIC

*Molecules; Peptides; Proteins; Simulation*

**20020040003** Wake Forest Univ., Bowman Gray School of Medicine, Winston-Salem, NC USA

**Oral Contraceptives Use by Young Women Reduces Peak Bone Mass** *Annual Report, 1 Sep. 2000-31 Aug. 2001*

Register, Thomas; Sep. 2001; 20p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8514

Report No.(s): AD-A399147; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of these studies was to determine the role that hypoandrogenemia plays in the effects of oral contraceptives (OC) on bone metabolism and peak bone mass (PBM) in young female rats. Adolescent/young adult Sprague-Dawley rats were treated with: (1) placebo; (2) OC; (3) OC supplemented with an androgen (methyltestosterone); or (4) an anti-androgen (bicalutamide) to determine the potential role that suppression of androgens plays on bone metabolism, bone architecture, and the attainment of PBM. Our specific aims were to determine: (1) If oral contraceptive steroid (OC) treatment leads to decreased peak bone mass in young intact female rats. Findings: OC use decreased the peak bone mass of young intact female rats; (2) If the addition of a non-aromatizable androgenic steroid to OCs prevents the detrimental effects of OC use on peak bone mass. Findings: The non-aromatizable androgenic steroid did not prevent the adverse effects of OCs to the growing skeleton of young rats at the dose used; and (3) If anti-androgen treatment mimics the effect of OC use on peak bone mass. Findings: The anti-androgen used did not mimic the adverse effect of OCs on the growing skeleton of young rats.

DTIC

*Bones; Hormones; Steroids; Metabolism*

**20020040004** Pittsburgh Univ., Pittsburgh, PA USA

**Mitochondrial Mechanisms of Neuronal Injury** *Annual Report, 1 Sep. 2000-31 Aug. 2001*

Reynolds, Ian J.; Hastings, Teresa G.; Sep. 2001; 98p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8627

Report No.(s): AD-A399149; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This project is investigating the contribution of mitochondria to neuronal injury. Our previous studies have shown that glutamate mediated injury to neurons requires mitochondrial calcium accumulation. However, we know little about the magnitude of the mitochondrial calcium load that causes injury, or the mechanisms that link calcium to neuronal death. We have now characterized the properties of calcium transport, the mechanisms of mitochondrial oxidant generation, and a novel interaction between these two parameters that may be of particular relevance to Parkinson's disease. We have also identified a new property of mitochondria in the form of spontaneous mitochondrial depolarizations, and have found that this property is expressed in many different cell types. We are also investigating the properties of cytochrome c release in relation to apoptosis, which may be an important regulator of mitochondrial function. Finally, we have begun to establish a cell culture model of Parkinsons disease so that we can apply some of our studies to specific, vulnerable cell populations. These studies are providing important new information related to the control of neuronal injury by mitochondrial function.

DTIC

*Calcium; Injuries; Mitochondria; Neurophysiology*

**20020040005** California Univ., Davis, CA USA

**Low-Level Sarin Neurotoxicity and Its Modulation by Pyridostigmine** *Annual Report, 30 Sep. 2000-29 Sep 2001*

Wilson, Barry W.; Oct. 2001; 32p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-97-C-7057

Report No.(s): AD-A399150; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The possibility that a combination of exposure to organophosphate esters (OPs) and the carbamate pyridostigmine bromide (PB) led to neurological symptoms (claimed to a low-grade organophosphate induced delayed neuropathy, OPIDN) in Gulf War veterans is under experimental study. Animals (hen, mouse) are treated with diisopropyl fluorophosphate (DFP) or sarin (GB) in the presence or absence of PB. We established subthreshold and threshold levels for the induction of OPIDN in hens repeatedly treated with TOCP or DFP. Preliminary findings suggest increased nerve damage when DFP-treated hens are concurrently treated with PB. In the mouse, large single doses of TOCP failed to induce clinical or pathological signs of OPIDN.

DTIC

*Bromides; Esters; Neurology; Organic Phosphorus Compounds; Nervous System*

**20020040054** Hahnemann Medical Coll. and Hospital, Philadelphia, PA USA

**The Functional Significance of the CSVTCG-Specific Receptor in Breast Carcinoma Progression** *Annual Report, 1 Jun. 2000-31 May 2001*

Sargiannidou, Irene; Tuszynski, George; Jun. 2001; 8p; In English

Contract(s)/Grant(s): DAMD17-00-1-0336

Report No.(s): AD-A399301; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have isolated a novel CSVTCG-specific tumor cell adhesion receptor and shown by immunohistochemical staining of human breast tumors that the receptor localizes to malignant ductal epithelium while no staining of epithelium in normal and benign tissues was observed. Preliminary studies suggest that the CSVTCG-specific receptor may function to promote the invasive behavior of breast epithelium and contribute to the development of malignancy. To test this hypothesis, we propose to transfect full-length receptor cDNA in the sense or antisense orientation in order to either over-express or block receptor expression in breast carcinoma cell lines. We will use vector constructs that constitutively express the green fluorescent protein in order to enable localization of tumor cells in our animal studies.

DTIC

*Cancer; Epithelium; Fluorescence; Adhesion; Tumors*

**20020040055** Rochester Univ., NY USA

**Acustimulation for the Control of Chemotherapy-Induced Nausea in Breast Cancer Patients** *Annual Report, 1 Aug. 2000-31 Jul. 2001*

Roscoe, Joseph A.; Aug. 2001; 22p; In English

Contract(s)/Grant(s): DAMD17-00-1-0424

Report No.(s): AD-A399300; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current experiment examines the efficacy of acustimulation (mild electrical stimulation to an acupuncture point) to the Neiguan (P6) acupuncture point (located on the ventral surface of the wrist) in controlling chemotherapy-induced NV. It is a randomized three-arm clinical trial testing the usefulness of an acustimulation wrist band for the relief of chemotherapy-induced nausea and vomiting as an adjunct to standard 5-HT3 antiemetics. Patients who experienced nausea at their first treatment are eligible to participate. Patients in the two treatment groups (i.e., correct location: band worn on the inside of the wrist and sham location: band worn on the outside of the wrist) put on the acustimulation wrist band prior to the administration of chemotherapy and wear it for five days. The use of an active acustimulation band in the sham condition should effectively control for both the placebo effect and for any effect due to the release of endorphins and will therefore speak directly to the efficacy of acupuncture point stimulation.

DTIC

*Cancer; Antiemetics and Antinauseants; Medical Science; Mammary Glands*

**20020040058** RAND Corp., Santa Monica, CA USA

**Pharmaceutical Technology Assessment for Managed Care: Current Practice and Suggestions for Improvement**

Bozzette, Samuel A.; D'Amato, Rebecca; Morton, Sally; Harris, Katherine; Meili, Robin; Jan. 2001; 85p; In English

Report No.(s): AD-A399257; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Increasingly powerful pharmaceuticals are of increasing clinical and economic importance to managed care organizations. Expenditures on pharmaceuticals have also been increasing, a trend driven by a number of factors, including the accelerating development of more-innovative and more-expensive agents; rising pharmaceutical prices; and higher utilization due to the aging of the population, direct-to-consumer advertising, and other factors. More often today, health plans and provider organizations are responsible for managing and paying for these cost increases, which creates an incentive for them to go beyond a focus on clinical effectiveness and safety to evaluate the cost-effectiveness of new drugs. In addition, the development of drug formularies and the current focus on best practices require that each new drug be assessed relative to available alternatives. The formal controls and guidelines resulting from managed care processes can increase quality and cost efficiency, but can also be a barrier to desirable innovations. Together, these developments have caused managed care organizations to realize that making good decisions on new pharmaceuticals is to their immediate financial and clinical benefit. Accordingly, many have expressed interest in improving their ability to evaluate new pharmaceuticals.

DTIC

*Cost Effectiveness; Medical Services; Pharmacology*

**20020040059** RAND Corp., Santa Monica, CA USA

**Evaluation of the Medicare-DoD Subvention Demonstration: Final Report**

Farley, Donna O.; Harris, Katherine M.; Davis, Lois M.; Ashwood, J. S.; Cherry, GERALYN K.; Sep. 2001; 170p; In English  
Report No.(s): AD-A399254; DRU-2684-CMS; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The Centers for Medicare and Medicaid Services (CMS), formerly the Health Care Financing Administration) and the Department of Defense (DoD) have been testing the feasibility of making Medicare-covered health care services available to Medicare-eligible DoD beneficiaries through the TRICARE program (the managed care program of the Military Health Service) and military treatment facilities (MTFs). The vehicle used was the Medicare-DoD Subvention Demonstration, which was established by the Balanced Budget Act of 1997 (BBA). The goal of the demonstration was to implement cost-effective alternatives for care for this dually eligible population while ensuring budget neutrality, that is, neither CMS's nor DoD's total costs increase. The Secretaries of the Department of Health and Human Services and of the Department of Defense executed a Memorandum of Agreement that specified how the subvention demonstration was to be designed and operated. The Memorandum provided for an independent evaluation of the demonstration, which RAND conducted. This report describes the final results of the RAND evaluation.

DTIC

*Military Operations; Medical Services; Health*

**20020040069** RAND Corp., Santa Monica, CA USA

**RESEARCH HIGHLIGHTS: Mental Health Care for Youth. Who Gets It? How Much Does It Costs? Who Pays? Where Does the Money Go?**

Jan. 2001; 4p; In English

Report No.(s): AD-A399222; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In the National Action Agenda for Children's Mental Health, the U.S. Surgeon General warns that the nation is facing public crisis in caring for children and adolescents with behavioral, psychological, and emotional problems. The report, released in January 2001, notes that 1 in 10 young people suffer from mental illness severe enough to cause some level of impairment. Yet fewer than 20 percent of these children receive needed treatment in any given year. Efforts to improve mental health care for children and adolescents are under way and include parity laws for private insurance and the reorganization of public services. (Parity laws mandate equal coverage for mental health and physical health care.) At the policy level, however, many of these efforts are hindered by the lack of an up-to-date, comprehensive national picture of which troubled children are getting care, how much it costs to provide it, who pays for that care, and how resources are being used. In fact, the most recent child-oriented studies, limited primarily to adolescents, report data that are 15 years old, predating the rapid growth of managed care. Moreover, since that time, a number of advances have been made in treating mental illness.

DTIC

*Medical Services; Mental Health; Insurance (Contracts); Children*

**20020040071** Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Victoria, Australia

**Evaluation of a Simple Immunological Test (sIgA) During the RAAF Survival Course**

Carins, J. E.; Booth, C. K.; Nov. 2001; 28p; In English

Report No.(s): AD-A399220; DSTO-RR-0224; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A simple marker of immune function, salivary immunoglobulin A (sIgA), was evaluated as a potential indicator of stress during the RAAF Survival School courses conducted in November 1999. Twenty-seven males and two females with an average age of 26 years participated in the study by keeping a food diary, collecting saliva samples and recording their health problems (daily checklist) and level of anxiety (State-Trait Anxiety Inventory). Participants height and weight changes were also recorded. Dietary restriction, consumption of alcohol, loss of weight and negative emotions were all shown to have a negative effect on sIgA. Salivary IgA was shown to be a useful marker of the severity of stresses encountered during the survival course.

DTIC

*Stress (Psychology); Immunology; Saliva*

**20020040074** California Univ., Los Angeles, CA USA

**New Gene Based Probes for Imaging Breast Cancer with PET Final Report, 1 Aug. 1998-31 Jul. 2001**

Gambhir, Sanjiv S.; Aug. 2001; 30p; In English

Contract(s)/Grant(s): DAMD17-98-1-8179

Report No.(s): AD-A399369; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We are developing methods to image her-2-neu oncogene over-expression in breast cancer using positron emission tomography (PET). Small oligodeoxynucleotides (ODNs) that are complementary to the Her-2-neu messenger RNA (mRNA) are being investigated as potential imaging probes. Fluorine-18 (2 hour half-life positron emitter) has been used to label 15 - 18 mer ODN probes. The labeling of an ODN to Fluorine-18 has been particularly troublesome because of the limited half-life and the complicated chemistry. We have explored multiple strategies and are trying to maximize yield and specific activity of our probes. With adequate synthesis of the ODN probes we will begin further cell testing and small animal imaging with microPET. We expect that the techniques developed will lead to methods to detect breast cancer in living subjects in the case that her-2-neu is over-expressed.

DTIC

*Genes; Cancer; Fluorine Isotopes; Ribonucleic Acids; Mammary Glands*

**20020040075** City Univ. of New York, NY USA

**Breast Cancer Screening Using Photonic Technology Annual Report, 15 Aug. 2000-14 Aug 2001**

Alfano, Robert R.; Sep. 2001; 63p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8147

Report No.(s): AD-A399367; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The research carried out during the current reporting period involved: (a) time-sliced and spectroscopic two-dimensional (2-D) near-infrared transillumination imaging of normal and cancerous in vitro human breast tissue specimens; (b) correlating the results of optical measurements with NMR measurements; (c) derivation of analytical solutions of the polarized photon transport equation that provides a more accurate analytical basis for developing three-dimensional (3-D) inverse image reconstruction techniques; and (d) development of forward models and 3-D inverse image reconstruction methods. Images recorded with earlier temporal slices of transmitted light were found to highlight cancerous tissues while those recorded with later slices accentuated normal fibrous tissues. Initial spectroscopic imaging experiments show that the ratio, R of light intensity transmitted through the cancerous tissue to that through the corresponding normal tissue show a wavelength dependent variation that has the potential to be used as a useful parameter for cancer identification. Analytical solutions of the polarized photon transport equation are more complete and enable description of polarized light imaging. Faster and more noise-resistant 3-D image reconstruction schemes are being pursued.

DTIC

*Photonics; Nuclear Magnetic Resonance; Parameter Identification; Polarized Light; Mammary Glands; Cancer*

**20020040076** California Univ., San Diego, La Jolla, CA USA

**Stage I Breast Cancer and Bone Mass in Older Women Annual Report, 1 Oct. 2000-1 Oct 2001**

Schneider, Diane L.; Kritz-Silverstein, Donna; Oct. 2001; 38p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0185

Report No.(s): AD-A399382; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The specific aims of the study are 1) to assess the bone mineral density of women 65 years of age and older with breast cancer in comparison with the bone mineral density of same aged women with normal mammograms; 2) to examine the risk factors associated with breast cancer and low bone mass in these two groups of women; 3) to develop a model based on the study population to determine the predictive value of low bone mass for risk of breast cancer. During the three years of this study, a total of 300 women (150 with breast cancer and 150 with a normal mammogram) aged 65 and older will be recruited from oncology and radiology offices to participate in a study consisting of one clinic visit. At the clinic visit, each subject will complete questionnaires detailing medical history, health habits, reproductive history, and medications. Height and weight will be measured. A blood sample will be drawn for storage. Bone mineral density will be measured at the forearm, hip, lumbar spine (L1-L4), and whole body using dual energy x-ray absorptiometry (DXA). The results of this study can be used 1) to identify the likelihood of low bone mass in older women with breast cancer; 2) to identify the risk factors that are common to both low BMD and breast cancer; and 3) to determine the feasibility of discontinuing mammography after 65 in women with low bone mass.

DTIC

*Bones; Cancer; Mammary Glands; X Ray Sources; Blood*

**20020040077** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Purification and Properties of the Extracellular Lipase, Lip A, from Acinetobacter SP.RAG-1**

Snellman, Erick A.; Feb. 19, 2002; 147p; In English

Report No.(s): AD-A399380; AFIT-CI-02-31; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The major objectives of this research were: (a) understand the temporal and spatial distribution of lipase production by *Acinetobacter* sp. RAG-1 during growth on hexadecane and triglycerides; (b) purify the extracellular lipase; and (c) to examine its role in modifying the fatty acid component of the bioemulsifier, emulsan, produced by this bacterium. To achieve these objectives, the lipase was produced and purified from RAG-1 cells grown on hexadecane and the properties of the protein investigated. The majority of the enzyme was released into the growth medium during transition to stationary phase. The lipase showed high stability in hexadecane medium where it remained active for longer than 48 hr. at 30 deg C. Therefore, minimal medium supplemented with 10 mM hexadecane was selected for purification of the lipase. An 8% yield and greater than 10-fold purification were achieved. The protein demonstrated little affinity for anion exchange resins. However, contaminating proteins were removed by passing crude supernatants over a Mono Q column. The lipase was further purified by hydrophobic interaction chromatography, employing a butyl sepharose matrix, and eluted with an increasing Triton X-100 gradient. The protein has an apparent molecular weight of 33 kDa, determined from SDS PAGE. LipA was found to be stable at pH values of 5.8 - 9.0 and showed optimal activity at approximately pH 9.0. The lipase remained highly active at temperatures up to 70 deg C and showed a 3-fold increase in activity over the standard assay temperature (30 deg C) at its temperature optimum (55 deg C). LipA was found to be active against a wide range of fatty acid esters of p-nitrophenyl but demonstrated higher activity toward medium length acyl chains (C6, C5).

DTIC

*Bacteria; Enzymes; Chromatography; Contamination; Temporal Distribution*

**20020040078** Washington Univ., Grant and Contract Services, Seattle, WA USA

**Environmental and Lifestyle Influences on Breast Cancer Risk: Clues from Women with Inherited Mutations in BRCA1 and BRCA2 Final Report, 1 Sep. 1998-31 Aug. 2001**

King, Mary-Claire; Sep. 2001; 19p; In English

Contract(s)/Grant(s): DAMD17-98-1-8257

Report No.(s): AD-A399378; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project aims to identify potentially preventable environmental influences on breast and ovarian cancer by focusing on a population of women with genetically inherited predisposition to the disease. This is an extension of our ongoing research into the genetics of breast and ovarian cancer among Jewish women in the New York City area. The IDEA project centered on female relatives of breast cancer patients with confirmed mutations in BRCA1 or BRCA2. Each relative provided a blood sample for mutation testing and completed an extensive questionnaire addressing epidemiologic factors in breast cancer risk. Among participants, inherited mutations in BRCA1 and BRCA2 were more frequent in women with a younger breast cancer diagnosis and in women with a breast and/or ovarian cancer family history. Breast cancer risks increased over time among women with mutations, suggesting the influence of environmental factors. The experiences and exposures of women with mutations who did and did not develop breast or ovarian cancer were compared to identify factors that ameliorate or exacerbate risk in this high-risk group. These risk factors may be generalized to women without inherited vulnerability to breast or ovarian cancer, as inherited cancer is virtually indistinguishable, clinically and biologically, from its non inherited counterpart.

DTIC

*Mutations; Genetics; Cancer; Mammary Glands; Blood; Diagnosis*

**20020040107** Materials Research Society, Warrendale, PA USA

**Dynamics in Small Confining Systems V. Symposium Held November 27-30, 2000, Boston, Massachusetts, U.S.A**

Drake, J. M.; Klafter, J.; Levitz, Pierre E.; Overney, Rene M.; Urbakh, M.; Jan. 2001; 394p; In English

Contract(s)/Grant(s): N00014-01-1-0233

Report No.(s): AD-A399276; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

The sixth symposium on 'Dynamics in Small Confining Systems', held November 27-30 at the 2000 MRS (Materials Research Society) Fall Meeting in Boston, Massachusetts, celebrated a decade of this series. The program of the symposium covered a broad range of topics related to static and dynamic properties of confining systems: probing of confined systems, structure and dynamics of liquids at interfaces, nano-rheology and tribology, adsorption, diffusion in pores, polymers and membranes, dielectric relaxation and biological aspects. Participants from various disciplines shared different points of view on the questions of how ultra small geometries can force a system to behave in ways significantly different from its behavior in the bulk, how this difference affects molecular properties, and how it is probed. There appears to be a continuing interest in the dynamics and thermodynamics of confined molecular systems. This symposium was an effective way to bring together different disciplines interested in common problems.

DTIC

*Polymer Chemistry; Enzymes; Dielectrics; Charged Particles; Rheology; Nanotechnology*

**20020040362** Boston Univ., Boston, MA USA

**Screening for Breast Cancer Using Near Field Infrared Spectroscopy of a Single Strand of Hair** *Annual Report, 1 Aug. 2000-31 Jul. 2001*

Erramilli, Shyamsunder; Hong, M. K.; Aug. 2001; 10p; In English

Contract(s)/Grant(s): DAMD17-00-1-0159

Report No.(s): AD-A399313; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A recent Australian study has used synchrotron x-ray diffraction to identify changes in the structure of hair that may be linked to either the occurrence of breast cancer, or the increased predisposition to breast cancer because of the presence of a mutation of the BRCA1 gene. We would like to develop a new method for the screening of breast cancer based on infrared spectroscopy of a single strand of human hair. Our study will provide an independent test of the proposed link between hair structure and breast cancer. In addition it may also provide a detailed understanding of how deposits in hair are linked to the formation of breast cancer, at a molecular level. Synchrotron x-ray studies require the use of large accelerators. Our proposed instrument is a table-top device with the possible potential for rapid, non-invasive, safe and inexpensive screening. This work involves an interdisciplinary collaboration between physicists, epidemiologists, and oncologists at Boston University Center for Photonics, Dartmouth College, and Dartmouth Hitchcock Medical Center.

DTIC

*Infrared Spectroscopy; Cancer; Technology Assessment; Hair; Mammary Glands*

**20020040365** Chicago Univ., Chicago, IL USA

**Genetics of Breast Cancer in Blacks** *Annual Report, 1 Sep. 2000-31 Aug. 2001*

Olopade, Olufunmilayo I.; Sep. 2001; 5p; In English

Contract(s)/Grant(s): DAMD17-00-1-0198

Report No.(s): AD-A399350; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Breast cancer in young black women is more virulent, leading to a decrease in the overall survival rates for African Americans diagnosed with breast cancer when compared to whites. Our studies provide the first concerted effort to seriously address the contribution of genetic risk factors to the high incidence and mortality from breast cancer in young black women. We have developed an efficient mechanism to recruit incident cases of early onset breast cancer with the goal of enrolling 75 - 100 new cases per year from Nigeria and 50 - 75 cases per year in the US. We have used the Chronic Disease Network - a collaborative framework for the study of international comparisons among black populations - to develop this infrastructure and we are now awaiting approval of our clinical protocol by the Human Subject Review Committee. In the next year, we will optimize our mutation detection assay using Denaturing High Performance Liquid Chromatography. We will recruit and analyze 200 US black women diagnosed with breast cancer at, or before, age 40, for BRCA1 and BRCA2 mutations and compare the incidence and spectrum of mutations to that seen in a matched cohort of African women.

DTIC

*Cancer; Genetics; Mammary Glands; Risk; Survival*

**20020040366** Armed Forces Research Inst. of Medical Sciences, Bangkok, Thailand

**Research and Operational Support for the Study of Militarily Relevant Infectious Diseases of Interest to Both USA and Royal Thai Governments** *Annual Report, 1 Jan.-31 Dec. 2001*

Sangkharomaya, Suebpong; Nitayaphan, Sorachai; Jan. 2002; 95p; In English

Contract(s)/Grant(s): DAMD17-01-2-0005

Report No.(s): AD-A399349; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Cooperative agreement # DAMD17-01-2-0005 was implemented January 1, 2001 to provide funding support for Royal Thai Army at Armed Forces Research Institute of Medical Sciences (AFRIMS) engaged in research activities in collaboration with U.S. Army. Administrative, logistical and scientific personnel required to support the ongoing U.S. Army AFRIMS research efforts, and utilities and maintenance required to support the U.S. Army AFRIMS research effort.

DTIC

*Infectious Diseases; Viruses; Military Psychology; Immunology; Medicine*

**20020040374** RAND Corp., Santa Monica, CA USA

**Labor and Population Program: Analyzing the Costs and Benefits of Early Childhood Interventions**

Jan. 2001; 2p; In English

Report No.(s): AD-A399352; RB-5051-CFP; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

As they pay more attention to accountability, funders and implementers of early childhood interventions are becoming more interested in comparing the benefits their programs produce and the costs they incur. RAND has issued a volume providing general guidance for performing such analyses. The report (Analyzing the Costs and Benefits of Early Childhood Interventions) also offers, as a case study, application of the guidance to a decision faced by the US Substance Abuse and Mental Health Services Administration and the Casey Family Programs in pursuing their Starting Early Starting Smart (SESS) program. This brief summarizes that guidance.

DTIC

*Costs; Medical Services; Mental Health*

**20020040383** Cold Spring Harbor Lab., New York, NY USA

**Third Biannual International Meeting on Microbial Pathogenesis and Host Response Final Report, 1 Sep. 2001-28 Feb. 2002**

Grodzicker, Terri I.; Feb. 2002; 7p; In English

Contract(s)/Grant(s): DAMD17-01-1-0747

Report No.(s): AD-A399399; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Throughout recorded history microbial pathogens have been a major cause of human disease and mortality. However, with the advent of effective antibiotics it seemed like the war on microbes had been won. Hence, for several decades health-related research shifted to topics like cancer, heart disease, and genetic diseases. While research in microbial pathogenesis slowed, the microbes continued to evolve. Microbial resistance to antibiotics developed faster than new antibiotics could be made available, and the resistance spread throughout the microbial world. The global expansion of food distribution networks increased the rapid dissemination of microbial pathogens. Simultaneously, emerging microbial pathogens filled new ecological niches, such as indwelling medical devices that provide a surface for biofilms and the growing population of patients who are immunocompromised due to primary infections such as HIV or due to therapies for chronic diseases. Furthermore, recent discoveries have demonstrated that some diseases (e.g. ulcers and coronary heart disease) previously believed to be caused by a genetic predisposition or environmental conditions are actually caused by or are strongly associated with microbes. Finally, humans have facilitated the development of microbial pathogens as agents of bioterrorism.

DTIC

*Pathogenesis; Microorganisms; Infectious Diseases*

**20020040395** Columbia Univ., New York, NY USA

**Dynamic Functional Mammography: A Non-Ionizing Imaging Technique Enhancing Early Detection of Breast Cancer Annual Report, 1 Oct. 2000-30 Sep. 2001**

Smith, Suzanne J.; Oct. 2001; 9p; In English

Contract(s)/Grant(s): DAMD17-98-1-8054

Report No.(s): AD-A399427; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the second year of this study, the imaging technology of Dynamic Functional Optical Mammography (DFOM) has continued to be used to scan patients scheduled for biopsy of breast lesions. These patients were scheduled for core or excisional breast biopsy on the basis of equivocal mammographic and ancillary clinical findings within ACR BI-Rads(Trademark) categories 3 or 4. Analysis of test results of 117 patients showed that DFOM modality detected cancer in 13 of the 15 patients in whom biopsies confirmed malignant lesions, giving a sensitivity of 87%. DFOM also correctly identified 79 of 102 benign lesions giving a specificity of 77%.

DTIC

*Mammary Glands; Cancer*

**20020040560** Alps-Adria Working Community on Maritime Undersea Hyperbaric Medicine, Opatija, Croatia

**1st Congress of the Alps-Adria Working Community on Maritime, Undersea, and Hyperbaric Medicine**

Petri, Nadan M.; Andric, Dejan; Ropac, Darko; Apr. 2001; 393p; In Croatian; 1st Congress of the Alps-Adria Working Community on Maritime, Undersea, and Hyperbaric Medicine, 18-21 Apr. 2001, Opatija, Croatia

Contract(s)/Grant(s): N00014-00-1-1005

Report No.(s): AD-A399179; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

Partial contents: The patron saints of some occupations associated with the sea, rivers, and lakes; Development of Hungarian Aeromedical and Maritime Medicine Center, Diving just for fun: any problems, Hyperbaric oxygen therapy and late consequences of radio-therapy in the patients with prostatic carcinoma, Implementation of international health regulations in the Republic of Slovenia, Organization of the Croatian Military Medical Corps on southern Croatian front from 1992 to 1995, Sanitary quality

of sea water in bathing sites along Slovenian coast from 1974 to 2000, Effects of 100% oxygen breathing in decompression illness in compressed air work, The influence of increased air pressure on the speed of mental processing during simulated "ascent" in diving to the depth of 30 meters, Diving in cage farming of fish, Preparations of medical equipment for salvage operations in sea catastrophes, Toxic or potentially toxic phytoplankton species in the Southern Adriatic Sea, Work-related injuries in Croatian seamen, Maritime police in illegal migrations suppression, "Divers disease" - the first report from Pula; Epidemiology of jellyfish skin lesions in the area of Kvarner, Malaria in the seamen of "Splosna plovba", Women and decompression sickness - is the risk real?, Women and scuba diving during menstrual period, Our experiences in the treatment of gas gangrene with hyperbaric oxygenation, and Accidental hypothermia - case reports and recommendations.

DTIC

*Aerospace Medicine; Alps Mountains (Europe); Diving (Underwater); Epidemiology; Adriatic Sea*

**20020040561** Association of Military Surgeons, Washington, DC USA

**MILITARY MEDICINE: International Journal of AMSUS, Volume 166**

Pierce, John R.; Writer, James V.; Sep. 2001; 88p; In English

Report No.(s): AD-A399177; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This supplement republishes the work of the U.S. Army Yellow Fever Board of 1900-1901 and several other articles that led to or followed their work. The original language, syntax and spelling used by the original authors are in some cases different from what we would expect today. In addition, some of the articles have been edited for space and the historical note preceding each article will indicate when this occurred.

DTIC

*Armed Forces (USA); Infectious Diseases; Medical Science*

**20020040564** RAND Health, Santa Monica, CA USA

**Evidence Based Care Models for Recognizing and Treating Alcohol Problems in Primary Care Settings**

Watkins, Katherine; Pincus, Harold A.; Tanielian, Terri L.; Jan. 2001; 58p; In English

Report No.(s): AD-A399185; RAND-MR-1491-SAMHSA; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Alcohol-related problems are a significant public health concern in the USA. Alcohol dependence, abuse, and problem drinking increase morbidity and mortality (McGinnis, 1993), and raise economic, social and health care costs (Institute for Health Policy, 1993; Rice, 1991; Manning, 1989; US department of Health and Human Services, 1993). A recent study estimated that the total economic cost of alcohol-related problems was \$148 billion in 1992: \$18.8 billion in health care costs, \$67.7 billion in lost productivity and \$19.7 billion in crime (Harwood, 1998). Effective treatments exist for the entire spectrum of alcohol-related problems (Fleming, 1997; CSAT TIP #28; NIAAA, 1995), but fewer than half of those individuals who need treatment actually receive it (Institute of Medicine, 1990). One in 5 men and 1 in 10 women who visit their primary care providers meet the criteria for at-risk drinking, problem drinking or alcohol dependence (Manwell et al, 1998); (Flemming and Manwell, 1999). Primary care physicians (PCPs) are in an ideal position to screen for alcohol problems, begin treatment, and monitor progress. However, primary care systems are not set up to support PCPs in recognizing and treating alcohol use disorders. Since many of these patients do not consult alcohol treatment specialists on their own, important opportunities for identification and treatment are missed (Alcohol Research and Health, 2000). A recent national survey of primary care physicians and patients noted that more than nine in ten physicians fail to identify substance abuse in adults. The majority of patients with substance abuse say that their primary care physician did nothing to either assess or treat their substance abuse (CASA, 2000). A recent study of primary care physicians in Ohio in which 4454 patient visits were observed revealed that screening for alcohol problems took place during 8% of the visits, and only 1% of the patients received counseling on alcohol problems.

DTIC

*Economics; Alcohols; Public Health; Sociology*

**20020040567** Texas Univ., M. D. Andersen Cancer Center, Houston, TX USA

**The Importance of ATM Mutations and Polymorphisms in Breast Cancer and Radiation Sensitivity Annual Report, 1 Oct. 2000-30 Sep. 2001**

Buchholz, Thomas A.; Oct. 2001; 18p; In English

Contract(s)/Grant(s): DAMD17-00-1-9260

Report No.(s): AD-A399302; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of my 4-year Career Development Award was to determine whether ATM heterozygosity contributes to breast cancer development and radiation injury. We sequenced the ATM cDNA of 93 breast cancer patients, 22 of whom experienced a normal tissue injury from radiation treatment. We found that none of these patients had an ATM mutation that resulted in a protein

truncation. This finding is consistent with publications from others. We did identify 3 repetitive single-base changes in the ATM cDNA that may represent missense mutations. We then compared the frequency of these single-base changes between the breast cancer patients and a control set of samples from 996 individuals without cancer. We found that one of these single-base changes was more commonly represented in the breast cancer patients (6.7% vs 1.6%,  $p=0.006$ ). To further assess whether this base change results in a functional consequence, we developed an in vitro assay to study the role the ATM protein plays in repair of double-strand DNA damage. We now plan to study cells with the identified single-base changes using this assay. We hypothesize that these single base changes affect a cellular phenotype previously shown to have relevance to breast cancer development and radiation injury risk.

DTIC

*Cancer; Mammary Glands; In Vitro Methods and Tests; Radiation Effects; Radiation Injuries*

**20020040569** Old Dominion Univ., Research Foundation, Norfolk, VA USA

**Pulsed Electric Field Effects on Biological Cells Final Report, 1 Dec. 1998-31 Nov. 2001**

Schoenbach, Karl H.; Beebe, Stephen J.; Buescher, E. S.; Liu, Shenggang; Nov. 30, 2001; 58p; In English

Contract(s)/Grant(s): F49620-99-1-0069; AF Proj. 2301

Report No.(s): AD-A399182; AFRL-SR-BL-TR-02-0040; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A new type of field-cell interaction, "Intracellular Electromanipulation", by means of nonthermal, wideband electromagnetic radiation is being studied. It is based on capacitive coupling to cell substructures, and has therefore the potential to affect transport processes across subcellular membranes. This was verified experimentally by applying electrical pulses of 60 nanosecond duration, with electric field amplitudes of 50kV/cm to human eosinophils in vitro. Besides causing poration of intracellular membranes without disrupting the outer cell membrane, sub-microsecond pulses were found to induce apoptosis in cells.

DTIC

*Cells (Biology); Electric Fields; Electromagnetic Radiation; Electric Pulses*

**20020040788** Mayo Clinic, Jacksonville, FL USA

**New Inhibitors of the Peripheral Site in Acetylcholinesterase That Specifically Block Organophosphorylation Final Report, 1 Sep. 1998-31 Aug. 2001**

Rosenberry, Terrone; Nov. 2001; 162p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-2-8019

Report No.(s): AD-A399471; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Acetylcholinesterase (AChE) is one of the most efficient enzymes known. The AChE active site consists of a narrow gorge with two separate ligand binding sites: an acylation site at the bottom of the gorge where substrate hydrolysis occurs and a peripheral site at the gorge mouth. In recent studies, we showed that ligands which bind specifically to the peripheral site can slow the rates at which other ligands enter and exit the acylation site, a feature we denoted steric blockade. We also demonstrated that cationic substrates can form a low affinity complex at the peripheral site that accelerates catalytic hydrolysis at low substrate concentrations but results in substrate inhibition at high concentrations because of steric blockade of product release. AChE is inactivated by organophosphates in pesticides and chemical warfare agents because organophosphates can pass through the peripheral site and phosphorylate the catalytic serine in the acylation site. We are investigating the design of cyclic inhibitors that will bind specifically to the peripheral site and present a pronounced steric blockade to organophosphates while allowing selective passage of acetylcholine to the acylation site. Cyclic inhibitors with affinities for the peripheral site in the sub-micromolar range have been identified.

DTIC

*Phosphorylation; Acetyl Compounds; Organic Phosphorus Compounds; Inhibitors*

**20020040809** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Organic Chemical Exposure and the Risk of Breast Cancer Among Active Duty Women in the US Army, 1980-1996**

Rennix, Christopher P.; Yore, Michelle M.; Amoroso, Paul J.; Mar. 2002; 89p; In English

Report No.(s): AD-A399679; USARIEM-T02-5; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Young women whose Army occupations involve use of organic solvents may be at particular risk of developing breast cancer. Our objective is to: (1) determine if the observed increase in incidence of breast cancer is associated with occupations with high exposure potential for organic solvents, (2) develop job exposure matrices to quantitatively assess the airborne chemical exposure concentrations and cumulative exposure to these chemicals, and (3) investigate the timing of occupational exposure to organic solvents and occurrence of breast cancer. Using the Total Army Injury and Health Outcomes Database, we conducted a cohort study of enlisted active duty Army women. Women whose jobs at diagnosis had a moderate to high exposure potential had a 48%

increased risk of breast cancer (95% CI = 1.01-2.07). In a case-control study, parous women who delayed the birth of their first child until after age 25 and had an occupational exposure to formaldehyde had an increased risk (OR 3.2, 95% CI = 1.5-6.9). Women 35 years and younger with a family history were also at increased risk (OR 12.0, 95% CI = 4.6-33). The findings support the hypothesis that breast tissue in a proliferative stage may be more susceptible to the effects of occupational exposure to organic solvents.

DTIC

*Solvents; Organic Materials; Mammary Glands; Cancer*

**20020040847** NASA Ames Research Center, Moffett Field, CA USA

**Alterations of Body Mass Gain of Neonates (P7&P14) During Centrifugation AT 2G**

Baer, L. A.; Corbin, B. J.; Wade, C. E.; [1996]; 1p; In English; FASEB Conference, 6-9 Apr. 1997, New Orleans, LA, USA; Sponsored by Federation of American Societies for Experimental Biology, USA

Contract(s)/Grant(s): NAS2-14263; No Copyright; Avail: Issuing Activity; Abstract Only

Previous research has shown animal body mass to be significantly affected by centrifugation. At the onset of centrifugation, animals have a selective loss of fat, causing an initial body mass loss. Body mass gain will resume at the same rate as uncentrifuged animals, but this subsequent gain will be lower. For this study, two different ages of Sprague Hawley neonate families were observed during centrifugation. Eight litters (dam with eight neonates) of postnatal day (PN) seven and four litters (dam with ten neonates) of PN 14 were separated into two separate groups each, centrifuge (+2G(sub z)) and environmental controls (EC) and placed into either the centrifuge or an animal holding unit in the centrifuge rotunda for a total of 16 days. P7: Total litter start mass of +2G(sub z) litter = 138.90 g/end = 311.0 g EC litter = 150.85 g/end = 516.9 g. P14: Total litter start mass of +2G(sub z) litter = 287.70 g/end = 762.5g; EC litter = 245 g/end = 942.9 g. An initial body mass loss was observed in both groups of +2G(sub z) animals for two days after the onset of centrifugation, but then an increase began to occur. Literature suggests adult animals at +2G(sub z), will have an initial loss, but will resume similar growth rates over time as compared to control animals. The P7 +2G(sub z) animals began to gain body mass, but showed a significantly slower growth rate than their EC animals for the duration of the test (pace). The P14 +2G(sub z) animals began to show similar growth rates to their EC after day nine. At day 16, both groups of +2Gz animals were significantly smaller than the EC animals (pace). At +2Gz, animals experience an initial body mass loss. Older animals are able to resume similar growth rates as their controls, but younger animals showed growth rates to be significantly reduced.

Author

*Centrifuging Stress; Gravitational Physiology*

**20020040865** Syracuse Univ., NY USA

**Protein-Based Three-Dimensional Memories Final Report, Jun. 1998-Jun 2000**

Jan. 2002; 152p; In English

Contract(s)/Grant(s): F30602-98-C-0105; AF Proj. 4954

Report No.(s): AD-A399541; AFRL-IF-RS-TR-2001-279; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Significant progress has been made in the remaining tasks, specifically materials development, protein optimization, computer interface development, and prototype development. The primary goal of the materials effort was to develop a polymer matrix for encapsulation of the protein, characterized by optical clarity, long-term stability, protein compatibility, and resistance to gel dehydration and contraction. Handled via subcontract to Wayne Wang of Carleton University in Ottawa, Canada, a poly(acrylamide) based hydrogel has been developed that fits the majority of these characteristics. Light scattering was achieved primarily by the addition of refractive index-matching agents, with sucrose achieving the best reduction. A newly developed high-density acrylamide matrix demonstrates the largest reduction of light scattering, by roughly one order of magnitude over previous gels. Optimization of the protein response was approached primarily through site-directed mutagenesis (SDM), with the goal of increasing the efficiency with which the branched photocycle can be assessed; two avenues were explored to this end, including enhancement of the 0-state yield and the quantum yield of the 0-> P transition. The former avenue increases the amount of P-state formed through simple mass transfer-a higher yield of 0 will result in more P formation, despite the 0-> P quantum efficiency. The latter approach seeks to directly increase the 0-> P quantum efficiency.

DTIC

*Proteins; Polymer Matrix Composites; Encapsulating*

**20020040866** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Environmental Medicine Genome Bank (EMGB): Hardy-Weinberg Equilibrium at an Eotaxin Locus on Chromosome 17**

Dikeidek, Murad; Bastille, Amy; Sonna, Larry A.; Lilly, Craig M.; Jan. 2002; 17p; In English; Prepared in cooperation with Brigham and Women's Hospital, Boston, MA

Report No.(s): AD-A399538; USARIEM-TR-T-02/14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Environmental Medicine Genome Bank (EMGB) was used to test a low cost, high throughput, polymerase chain reaction (PCR) - based genetic strategy to distinguish 3 genotypes for a single nucleotide polymorphism (SNP) in the eotaxin gene located on chromosome 17. Using amplification refractory mutation system PCR (ARMS-PCR), we determined the eotaxin ALA23-THR23 genotypes of 233 samples in the EMGB. The observed allele frequencies were then used to determine the distribution of genotypes that would be expected from the assumptions of the Hardy-Weinberg equilibrium. It was found that, for the overall cohort and for all but one small, heterogeneous subpopulation, the EMGB was in Hardy-Weinberg equilibrium at this locus. The EMGB can therefore serve as a useful source of control material for studies of genes located near this locus at cytogenetic position 17q21.

DTIC

*Deoxyribonucleic Acid; Chromosomes; Genetics; Genes; Genome*

**20020040868** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Evaluation of an In Vitro of Human Immune Activation Induced by Freeze-Thaw Tissue Damage**

DuBose, D. A.; Rufolo, D. M.; Morehouse, D. H.; Feb. 2002; 24p; In English

Report No.(s): AD-A399591; USARIEM-T-02/13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In training and in combat, soldiers are under the constant threat of injury. Injury that results in tissue necrosis can activate the immune system and ultimately enhance disturbances in organ function. Knowledge of the immune activation mechanisms may lead to methods of reducing tissue damage. Mechanistic studies require precise control over the complex factors that coordinate the tissue injury cascade. An in vitro model would provide such a level of control. However, the feasibility of obtaining the required immune system tissues, such as human whole blood (HWP), endothelial cells and keratinocytes from the same human donor is unlikely. As such, an in vitro model comprised of tissues from immunologically distinct donors is perhaps the next best approach, but this necessitates an experimental design that controls for adverse histocompatibility or tissue rejection reactions. The current study employed permeable membranes to physically separated immunologically distinct immune system tissues.

DTIC

*Immunity; In Vitro Methods and Tests; Education; Experiment Design; Tissues (Biology)*

**20020040871** Cornell Univ., Ithaca, NY USA

**Structural Studies of a New Nuclear Target for EGF Receptor Tyrosine Kinases Annual Report, 15 Jul. 2000-14 Jul 2001**

Calero, Guillermo A.; Cerione, Richard A.; Clardy, Jon; Aug. 2001; 17p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9157

Report No.(s): AD-A399603; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project involves structural studies of a nuclear target for the EGF receptor, and the related Neu/ErbB2 tyrosine kinase, named the CBC for RNA-capped binding protein complex. The CBC consists of two subunits, CBP20 (Mr 18 Kda) and CBPBO (Mr 90 Kda), and undergoes a growth factor (EGF, heregulin)-dependent binding of RNAs transcribed by the RNA polymerase II at a 5' cap structure that consists of a guanosine residue methylated at the N7 position. This represents a first key step in the cap-dependent splicing of precursor messenger RNA (mRNA) and in the nucleocytoplasmic transport of U snRNAs which are necessary for the formation of the spliceosome complexes. While, EGF stimulates CBC activity, it is most strongly stimulated by heregulin, an activator of the Neu/ErbB2 tyrosine kinase, and appears to be constitutive in breast cancer where Neu/ErbB2 expression is high. Thus, we believe that the CBC represents an exciting nuclear target for receptor tyrosine kinases, linking growth factor-dependent gene expression to RNA processing. We have solved the atomic structure of the CBC in complex with m7GpppG at 2.2 Å. The atomic structure of this triple complex represents the second eukaryotic cap binding structure solved to date and reveals interesting aspects of capped RNA binding and regulation.

DTIC

*Estrogens; Atomic Structure; Gene Expression; Ribonucleic Acids; Cancer; Tyrosine; Guanosines*

**20020040873** Northeastern Univ., Boston, MA USA

**Solid-Phase Combinatorial Approach to Estradiol Tamoxifen/Raloxifene Hybrids: Novel Chemotherapeutic/Prophylactic Selective Estrogen Receptor Modulators (SERM) Annual Report, 1 Jul. 2000-30 Jun. 2001**

Hanson, Robert N.; Jul. 2001; 46p; In English

Contract(s)/Grant(s): DAMD17-00-1-0384

Report No.(s): AD-A399600; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this project is the development of new chemotherapeutic agents for the treatment of hormone-responsive breast cancer using a solid phase approach to synthesize new agents having features common to both steroids and antiestrogens. During the past year we have functionalized the carboxy resin with both the E-and Z-tributylstannylvinyl estradiol. We have prepared and characterized the initial series of iodophenoxyalkylamines that will be coupled to the resin-bound steroid. The biological assays have been established and validated using series of previously prepared compounds. Molecular modeling and NMR spectrometric methods for conformational analyses and for data analysis have been developed. The next years specific aims involve the synthesis and evaluation of the initial series of target compounds.

DTIC

*Combinatorial Analysis; Solid Phases; Estrogens; Cancer; Nuclear Magnetic Resonance*

**20020040877** Manitoba Univ., Winnipeg, Manitoba Canada

**Isolation of Estrogen-Responsive Genes in Human Breast Cancer Cells Annual Report, 1 Sep. 2000-1 Sep 2001**

Davie, James R.; Oct. 2001; 52p; In English

Report No.(s): AD-A399358; DAMD17-00-1-0319; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this proposal is to isolate estrogen-responsive genes in human breast cancer cells. Cisplatin and formaldehyde cross-link protein to DNA, formaldehyde also cross-links protein to protein. Chromatin immunoprecipitation (ChIP) using anti-estrogen receptor (ER) antibodies was applied to isolate ER-bound DNA in situ. This protocol should isolate all ER-bound DNA fragments. Our first specific aim was to establish a protocol to isolate DNA bound in situ to ER, and characterize this ER-bound DNA. We have carried out chromatin immunoprecipitation procedure using an anti-ER monoclonal antibody and an ER(+) human breast cancer T5 cell to isolate ER-bound DNA. Southern blot analysis shows that ER-bound DNA contains ER-responsive genes (such as PR, ER, pS2 and c-myc), but not control lambda-DNA. The pS2 gene promoter was analyzed using electrophoretic mobility shift assay, and three Sp1/Sp3 binding sequences were identified. A high resolution mapping protocol to find location of ER along the pS2 gene promoter was developed. PCR results indicated that estradiol increases ER binding to pS2 promoter. We are testing the optimum conditions to construct an ER-bound genomic DNA library.

DTIC

*Cancer; Deoxyribonucleic Acid; Estrogens; Genes; Mammary Glands*

**20020040881** Henry Ford Health System, Detroit, MI USA

**Understanding Factors Related to Prostate, Lung, and Colorectal Screening Among African American Men Annual Report, 4 Jan. 2000-3 Jan 2001**

Ford, Marvella; Feb. 2001; 336p; In English

Contract(s)/Grant(s): DAMD17-99-1-9005

Report No.(s): AD-A399362; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The study aims were to: (1) use a randomized trial to evaluate an ongoing innovative intervention designed to facilitate screening adherence among African American men aged 55(+) years in the screening arm of the Prostate, Lung, Colorectal, and Ovarian (PLCO) Cancer Screening Trial; and (2) develop a survey to assess perceptions of cancer screening among African American men. No statistically significant differences were found in age, education or income between the intervention (n=301) and control (n=300) groups. A total of 9,949 calls have been made to intervention group participants to address competing needs preventing screening adherence. Survey items found through a literature search were placed into the Preventive Health Model framework. Two focus groups were held to evaluate the developing survey. Focus group results show cognitive/psychological factors of fear and anxiety regarding cancer diagnosis and lack of knowledge about screening tests and benefits. Wives and children were cited as the most important social support and influence persons affecting screening behavior. Programmatic/systemic screening-related factors included a trusted health care provider and health insurance. A final survey was developed. Abstracts were submitted for presentation at two national meetings. Study findings could help African American men benefit from participation in prostate cancer research.

DTIC

*Cancer; Health; Prostate Gland; Surveys; Risk; Psychological Effects*

**20020040907** NASA Ames Research Center, Moffett Field, CA USA

**Aspects of the Development of Housing for the Spaceflight of Pregnant and Lactating Rats with Neonates**

Hinds, William E., NASA Ames Research Center, USA; Mayer, David J., NASA Ames Research Center, USA; Evans, Juli, NASA Ames Research Center, USA; Spratt, Shahn, Lockheed Martin Engineering and Sciences Co., USA; Lane, Philip K., Lockheed Martin Engineering and Sciences Co., USA; Rodriguez, Shari L., Lockheed Martin Engineering and Sciences Co., USA; Navidi, Meena, Lockheed Martin Engineering and Sciences Co., USA; Armstrong, Rachel, Bionetics Corp., USA; Lemos, Bonnie, Bionetics Corp., USA; [1996]; 1p; In English; 27th International Conference on Environmental Systems, 14-17 Jul. 1997, Lake Tahoe, NV, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Recent and upcoming spaceflights are investigating the effect of weightlessness on developing neural and organ systems. Pregnant rats and dams with neonates have to be accommodated in cages that support the special requirements of these animals. Extensive ground testing of cage concepts, the effect of launch and landing stresses on the maintenance of pregnancy and maternal behavior at different neonatal ages, and techniques for monitoring adaptability to change are discussed. A spaceflight opportunity for the NIH.R3 payload of rat families at three different postnatal ages demonstrated that the survival of very young animals was not good but that older newborns could be returned to Earth in reasonably good health. The development of cages for the Research Animal Holding Facility (RAHF) to support the flight of neonates on Neurolab was continued and incorporated modifications that were demonstrated by the NIH.R3 flight. Other modifications to the RAHF are discussed. Data from biocompatibility and experiment verification testing are presented.

Author

*Space Flight; Embryos; Pregnancy; Animals*

## 52

### AEROSPACE MEDICINE

*Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.*

**20020039617** Bionetics Corp., Moffett Field, CA USA

**Rheoencephalographic (REG) Assessment of Head and Neck Cooling for use with Multiple Sclerosis Patients**

Montgomery, Leslie D., Bionetics Corp., USA; Ku, Yu-Tsuan E., Bionetics Corp., USA; [1995]; 1p; In English; IX International Conference on Electrical Bio-Impedance, 26-30 Sep. 1995, Heidelberg, Germany

Contract(s)/Grant(s): RTOP 199-61-62; No Copyright; Avail: Issuing Activity; Abstract Only

We have prepared a computer program (RHEOSYS:RHEOencephalographic impedance trace scanning SyStem) that can be used to automate the analysis of segmental impedance blood flow waveforms. This program was developed to assist in the post test analysis of recorded impedance traces from multiple segments of the body. It incorporates many of the blood flow, segmental volume, and vascular state indices reported in the world literature. As it is currently programmed, seven points are selected from each blood flow pulse and associated ECG waveform: 1. peak of the first ECG QRS complex, 2. start of systolic slope on the blood flow trace, 3. maximum amplitude of the impedance pulse, 4. position of the dicrotic notch, 5. maximum amplitude of the postdicrotic segment, 6. peak of the second ECG QRS complex, and 7. start of the next blood flow pulse. These points we used to calculate various geometric, area, and time-related values associated with the impedance pulse morphology. RHEOSYS then calculates a series of 34 impedance and cardiac cycle parameters which include pulse amplitudes; areas; pulse propagation times; cardiac cycle times; and various measures of arterial and various tone, contractility, and pulse volume. We used this program to calculate the scalp and intracranial blood flow responses to head and neck cooling as it may be applied to lower the body temperatures of multiple sclerosis patients. Twelve women and twelve men were tested using a commercially available head and neck cooling system operated at its maximum cooling capacity for a period of 30 minutes. Head and neck cooling produced a transient change in scalp blood flow and a significant, (Pis less than 0.05) decrease of approx. 30% in intracranial blood flow. Results of this experiment will illustrate how REG and RHEOSYS can be used in biomedical applications.

Author

*Cardiovascular System; Electrocardiography; Neck (Anatomy); Cooling Systems; Cranium; Blood Flow; Body Temperature*

**20020039693** Institute for Nutrition and Food Research TNO, Zeist, Netherlands

**Improvement Risk Profile Army Personnel, Part 1, Methods for Skinfold Measurements Final Report Verbetering Risicoprofiel Krijgsmachtpersoneel, Deel 1, Methoden voor Het Vaststellen van Lichaamssamenstelling**

Jansen-vanderVet, M., Institute for Nutrition and Food Research TNO, Netherlands; December 2001; 45p; In Dutch

Contract(s)/Grant(s): A01/KL/114; TNO Proj. 22013/01.01

Report No.(s): TD-2001-0383-Pt-1; V4372-Pt-1; Copyright; Avail: Issuing Activity

As part of the project "Improvement Risk Profile Army Personnel" a literature study is conducted to evaluate different methods of measuring body composition. The aim was to establish the suitability of different methods to measure body composition in army personnel, in comparison to the currently used skinfold measurements. Thirteen different methods were compared on four different aspects of importance, i.e. cost, burden on the army personnel, reproducibility and validity of the method. Bioelectrical Impedance Analysis (BIA) seemed to meet the requirements best, therefore a more extensive comparison was made between skinfold measurements and BIA. No large differences were discovered between cost or burden on the army personnel, but reproducibility and validity were found to be better in BIA than skinfold measurements. In both methods it is important to use population specific equations, in order to reduce the error on a group and individual level. Although little information is available on measuring individual changes in body composition using BIA, all in all the accuracy of BIA is better than that of skinfold measurements.

Author

*Body Composition (Biology); Military Operations; Bioelectricity; Skin Resistance*

**20020039719** NASA Ames Research Center, Moffett Field, CA USA

**NASA's Technology Transfer Program for the Early Detection of Breast Cancer**

Schmidt, Gregory, NASA, USA; Frey, Mary Anne, NASA, USA; Vernikos, Joan, NASA, USA; Winfield, Daniel, Research Triangle Inst., USA; [1996]; 2p; In English; 18th Annual IEEE/EMBS International Conference, 31 Oct. - 3 Nov. 1996, Amsterdam, Netherlands; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA) has led the development of advanced imaging sensors and image processing technologies for space science and Earth science missions. NASA considers the transfer and commercialization of such technologies a fundamental mission of the agency. Over the last two years, efforts have been focused on the application of aerospace imaging and computing to the field of diagnostic imaging, specifically to breast cancer imaging. These technology transfer efforts offer significant promise in helping in the national public health priority of the early detection of breast cancer.

Author

*Cancer; Imaging Techniques; Mammary Glands; Aerospace Technology Transfer; Diagnosis*

**20020039729** NASA Ames Research Center, Moffett Field, CA USA

**Cerebrovascular Responses During Lower Body Negative Pressure-Induced Presyncope**

Kuriyama, Kana, NASA Ames Research Center, USA; Watenpugh, D. E., NASA Ames Research Center, USA; Hargens, Alan R., NASA Ames Research Center, USA; Ueno, T.; Ballard, R. E.; Fortney, S. M.; [1996]; 1p; In English; Aerospace Medicine Association Meeting, 11-15 May 1997, Chicago, IL, USA; Sponsored by Aerospace Medical Association, USA

Contract(s)/Grant(s): RTOP 199-26-12-38; RTOP 199-26-12-34; No Copyright; Avail: Issuing Activity; Abstract Only

Reduced orthostatic tolerance is commonly observed after space flight, occasionally causing presyncopal conditions. Although the cerebrovascular system may play an important role in presyncope, there have been few reports concerning cerebral hemodynamics during presyncope. The purpose of this study was to investigate cerebrovascular responses during presyncope induced by lower body negative pressure (LBNP). Seven healthy male volunteers were exposed to LBNP in steps of -10 mmHg every 3 min until presyncopal symptoms were detected. Blood pressure (BP) and heart rate (HR) were measured with a finger cuff. Cerebral tissue oxy- and deoxy- hemoglobin (Hb) concentrations were estimated using near infrared spectroscopy (NIRS). Cerebral blood flow (CBF) velocity at the middle cerebral artery was measured with Transcranial Doppler Sonography (TCD). We focused on the data during the 2 min before endpoint. BP marked a gradual decrease (91 to 86 mmHg from 2 min to 30 sec before endpoint), which was accelerated along with HR decrease during the final 30 sec (86 to 71 mmHg). Cerebral oxy-Hb concentration decreases as presyncope is approached while total-Hb concentration remains fairly constant. TCD reveals a decrease in the CBF velocity. The TCD and NIRS results suggest that CBF decreases along with the BP decrease. Cerebrovascular responses during presyncope are closely related to cardiovascular responses.

Author

*Syncopal; Brain Circulation; Lower Body Negative Pressure; Blood Pressure; Heart Rate; Hemoglobin; Hemodynamics*

**20020039732** NASA Ames Research Center, Moffett Field, CA USA

**Overview of LBNP Exercise as a Countermeasure for Long-Duration Space Flight**

Hargens, Alan R., NASA Ames Research Center, USA; [1996]; 1p; In English; Aerospace Medicine Association Meeting, 11-15 May 1997, Chicago, IL, USA; Sponsored by Aerospace Medical Association, USA

Contract(s)/Grant(s): RTOP 199-26-12-34; RTOP 199-26-12-38; No Copyright; Avail: Issuing Activity; Abstract Only

Theoretically, an integrated countermeasure for extended exposure to microgravity should combine high loads on the musculoskeletal system, normal regional distributions of transmural pressure across blood vessels and stimulation of normal neuromuscular locomotor patterns. Our strategy was to develop an exercise apparatus which induces cardiovascular and musculoskeletal strains equal to or greater than those on Earth without the need for a costly centrifugation apparatus. An LBNP chamber was designed to contain a treadmill upon which 8 male bed-rest subjects could exercise daily in supine posture for 40 min at cardiovascular and musculoskeletal loads up to 120% of those in upright posture on Earth. We undertook two 14 day bed-rest studies to investigate the mechanism of action and efficacy of our LBNP exercise concept. We examined the same 8 subjects in both 14 day bed rest (6 deg. head-down tilt, HDT) studies, assigning 4 subjects to 40 minutes of supine running exercise per day up to 1.2 BW of footward force, while the remaining 4 subjects constituted the non-exercise "control" group. Three months after the first 14 day HDT study, the two groups were reversed so that the previous non-exercise group received the same 40 min of supine jogging per day up to 1.2 BW, while the previously-exercised group did not exercise during the 14 days of HDT. This panel reviews the results obtained from an integrated, multiple system standpoint.

Author

*Lower Body Negative Pressure; Physiological Responses; Physical Exercise; Microgravity; Long Duration Space Flight; Head Down Tilt; Bed Rest*

**20020039734** NASA Ames Research Center, Moffett Field, CA USA

**Daily Supine LBNP Treadmill Exercise Maintains Upright Exercise Capacity During 14 Days of Bed Rest**

Ertl, Andy C., Vanderbilt Univ., USA; Watenpaugh, D. E., NASA Ames Research Center, USA; Hargens, Alan R., NASA Ames Research Center, USA; Fortney, S. M.; Lee, S. M. C.; Ballard, R. E.; William, J. M.; [1996]; 1p; In English; Aerospace Medicine Association Meeting, 11-15 May 1997, Chicago, IL, USA; Sponsored by Aerospace Medical Association, USA

Contract(s)/Grant(s): NAGW-4031; RTOP 199-26-12-34; RTOP 199-14-11-13; RTOP 199-26-12-38; No Copyright; Avail: Issuing Activity; Abstract Only

Exposure to microgravity or bed rest reduces upright exercise capacity. Exercise modes, durations, and intensities which will effectively and efficiently counteract such deconditioning are presently unresolved. We that daily supine treadmill interval training with lower body negative pressure (LBNP) would prevent reduction in upright exercise capacity during 14 days of 6 deg. head-down bed rest (BR). Eight healthy male subjects underwent two 14 day BR protocols separated by 3 months. In a crossover design, subjects either remained at strict BR or performed 40 min of daily exercise consisting of supine walking and running at intensities varying from 40-80% of pre-BR upright peak oxygen uptake (VO<sub>2</sub>). LBNP during supine exercise was used to provide 1.0 to 1.2 times body weight of footward force. An incremental upright treadmill test to measure submaximal and peak exercise responses was given pre- and post-BR. In the non-exercise condition, peak VO<sub>2</sub> and time to exhaustion were reduced 16 +/- 4% and 10 +/- 1% (p less than 0.05), respectively, from pre-BR. With LBNP exercise these variables were not significantly different (NS) from pre-BR. During submaximal treadmill speeds after BR, heart rate was higher (11 +/- 11 bpm, p less than 0.05) and respiratory exchange ratio was elevated (p less than 0.05) in the no exercise condition. Both were maintained at pre-BR levels in the LBNP exercise condition (NS from pre-BR). Since this supine treadmill interval training with addition of LBNP maintained upright exercise responses and capacity during BR, this countermeasure may also be effective during space flight.

Author

*Aerospace Medicine; Lower Body Negative Pressure; Physical Exercise; Microgravity; Physiological Responses; Bed Rest; Head Down Tilt*

**20020039748** NASA Ames Research Center, Moffett Field, CA USA

**Gait, Balance, Leg Strength, and Sprint Speed After Bedrest with LBNP Exercise**

Boda, Wanda L., NASA Ames Research Center, USA; Watenbaugh, D. E., NASA Ames Research Center, USA; Ballard, R. E., NASA Ames Research Center, USA; Fortney, S. M., NASA Ames Research Center, USA; Ertl, A. C., NASA Ames Research Center, USA; Lee, S. M. C., NASA Ames Research Center, USA; William, J. M., NASA Ames Research Center, USA; Hargens, Alan R., NASA Ames Research Center, USA; [1997]; 1p; In English; Aerospace Medicine Association Meeting, 11-15 May 1997, Chicago, IL, USA; Sponsored by Aerospace Medical Association, USA

Contract(s)/Grant(s): RTOP 199-26-12-34; RTOP 199-26-12-38; No Copyright; Avail: Issuing Activity; Abstract Only

Microgravity and bedrest (BR) result in similar physiological decrements such as loss of muscle mass, muscle strength and balance. Previous studies analyzing exercise within lower body negative pressure (LBNP) have found that gait is similar in LBNP on a vertical treadmill and overground exercise on a horizontal treadmill. Since treadmill exercise is known to increase muscular strength and endurance, we tested the hypothesis that LBNP exercise on a vertical treadmill would prevent or attenuate many of the physical decrements which occur during bedrest. Based on our positive results from diverse tests of post-BR function, we believe that exercise within LBNP is worth pursuing as a countermeasure for reducing the physical deterioration that occurs during bedrest and microgravity.

Author (revised)

*Bed Rest; Lower Body Negative Pressure; Physical Exercise; Leg (Anatomy); Muscular Strength; Aerospace Medicine; Balance*

**20020039782** NASA Ames Research Center, Moffett Field, CA USA

**Sleep and Rest Requirements: Physiological Considerations**

Neri, David F., NASA Ames Research Center, USA; [1997]; 1p; In English; Aerospace Medical and Environmental Medicine Meeting, 12-16 May 1997, Chicago, IL, USA

Contract(s)/Grant(s): RTOP 505-64-53; No Copyright; Avail: Issuing Activity; Abstract Only

Sleep is a vital physiological need which must be met to insure optimal functioning. A single night of significantly shortened sleep negatively impacts performance, alertness, and mood. Restricted sleep studies have shown that even a relatively small amount of sleep loss over several consecutive days can be additive and result in a cumulative sleep debt with similar detrimental effects. Compounding the problem of sleep loss in the operational environment is the poor correlation between subjective reports of sleepiness and objective measures of physiological sleep need. Some of the factors determining how sleepy an individual is at a given point in time are: (1) individual characteristics (e.g., amount of prior sleep and wakefulness, circadian phase, age), (2) environmental conditions (e.g., noise, temperature, amount of social interaction), and (3) task variables (e.g., signal rate, workload). Although sleep need can be masked with medications, the only way to reduce it is with sleep itself. The timing of the sleep period can affect sleep duration and quality and thus its restorative strength. The data are clear that increasing sleep time results in improved alertness. This paper will briefly review the scientific findings on sleep need, the effects of sleep loss, napping strategies, and the implications of incorporating physiologically sound sleep and rest strategies into the operational aviation environment.

Author

*Alertness; Circadian Rhythms; Sleep Deprivation; Workloads (Psychophysiology)*

**20020039783** NASA Ames Research Center, Moffett Field, CA USA

**Non-Invasive Measurement of Intracranial Pressure Pulsation using Ultrasound**

Ueno, Toshiaki, NASA Ames Research Center, USA; Ballard, R. E., NASA Ames Research Center, USA; Yost, W. T., NASA Ames Research Center, USA; Hargens, A. R., NASA Ames Research Center, USA; [1997]; 1p; In English; Aerospace Medicine Association Meeting, 11-15 May 1997, Chicago, IL, USA; Sponsored by Aerospace Medical Association, USA

Contract(s)/Grant(s): RTOP 199-26-12-34; RTOP 199-26-12-38; No Copyright; Avail: Issuing Activity; Abstract Only

Exposure to microgravity causes a cephalad fluid shift which may elevate intracranial pressure (ICP). Elevation in ICP may affect cerebral hemodynamics in astronauts during space flight. ICP is, however, a difficult parameter to measure due to the invasiveness of currently available techniques. We already reported our development of a non-invasive ultrasound device for measurement of ICP. We recently modified the device so that we might reproducibly estimate ICP changes in association with cardiac cycles. In the first experiment, we measured changes in cranial distance with the ultrasound device in cadavera while changing ICP by infusing saline into the lateral ventricle. In the second experiment, we measured changes in cranial distance in five healthy volunteers while placing them in 60 deg, 30 deg head-up tilt, supine, and 10 deg head-down tilt position. In the cadaver study, fast Fourier transformation revealed that cranial pulsation is clearly associated with ICP pulsation. The ratio of cranial distance and ICP pulsation is 1.3microns/mmHg. In the tilting study, the magnitudes of cranial pulsation are linearly correlated to tilt angles ( $r=0.87$ ). The ultrasound device has sufficient sensitivity to detect cranial pulsation in association with cardiac cycles. by analyzing the magnitude of cranial pulsation, estimates of ICP during space flight are possible.

Author

*Attitude (Inclination); Cerebrum; Cranium; Exposure; Heart; Hypokinesia; Microgravity; Physiological Responses*

**20020039785** NASA Ames Research Center, Moffett Field, CA USA

**A Rorschach Test for Visual Classification Strategies**

Watson, Andrew B., NASA Ames Research Center, USA; Rosenholtz, Ruth, NASA Ames Research Center, USA; [1996]; 1p; In English; Association for Research in Vision and Ophthalmology Annual Meeting, 11-16 May 1997, Fort Lauderdale, FL, USA Contract(s)/Grant(s): RTOP 199-06-12-39; No Copyright; Avail: Issuing Activity; Abstract Only

Contemporary models of pattern, detection and discrimination often employ template matching, but there have been few direct tests of this proposition. Adopting a method developed by Ahumada, we have analyzed how human observers discriminate between two letters of the alphabet ('c' and 'x'). The stimulus consisted of a one degree tall letter plus a four degree field of static white noise, both displayed for 16 frames at a 67 Hz frame rate. Our font and display dimensions approximated those of Solomon and Pelli. The observer identified the letter presented. A QUEST staircase varied letter contrast to maintain a 75% correct rate. For each trial, we preserved the information required to reconstruct the noise field. Possible trial categories based on (signal, response) pairs are: (c,c), (c,x), (x,c), (x,x). Noise fields were averaged separately for each category, and a final classification image was obtained by averaging the four mean images after inverting the sign of categories in which x was the response. If the observer employs a template, it should be revealed in the classification image. The lowpass-filtered classification image derived from 2048 responses of one observer is shown here, along with the corresponding ideal template. An approximation to the ideal template can be seen appropriately located within the classification image. We have also simulated and will discuss the classification images expected from various discrimination models in this experimental context. The construction of classification images appears to be a powerful tool for studying classification strategies used by human observers. Like a Rorschach test, it surreptitiously discovers the inner desires of the visual system.

Author

*Image Classification; Rorschach Tests; Computer Vision*

**20020039786** NASA Ames Research Center, Moffett Field, CA USA

**DCTune Perceptual Optimization of Compressed Dental X-Rays**

Watson, Andrew B., NASA Ames Research Center, USA; [1996]; 3p; In English; Image Perception at MI 1997, 22-28 Feb. 1997, Newport Beach, CA, USA

Contract(s)/Grant(s): RTOP 199-06-12; No Copyright; Avail: Issuing Activity; Abstract Only

In current dental practice, x-rays of completed dental work are often sent to the insurer for verification. It is faster and cheaper to transmit instead digital scans of the x-rays. Further economies result if the images are sent in compressed form. DCTune is a technology for optimizing DCT (digital communication technology) quantization matrices to yield maximum perceptual quality for a given bit-rate, or minimum bit-rate for a given perceptual quality. Perceptual optimization of DCT color quantization matrices. In addition, the technology provides a means of setting the perceptual quality of compressed imagery in a systematic way. The purpose of this research was, with respect to dental x-rays, 1) to verify the advantage of DCTune over standard JPEG (Joint Photographic Experts Group), 2) to verify the quality control feature of DCTune, and 3) to discover regularities in the optimized matrices of a set of images. We optimized matrices for a total of 20 images at two resolutions (150 and 300 dpi) and four bit-rates (0.25, 0.5, 0.75, 1.0 bits/pixel), and examined structural regularities in the resulting matrices. We also conducted psychophysical studies (1) to discover the DCTune quality level at which the images became 'visually lossless,' and (2) to rate the relative quality of DCTune and standard JPEG images at various bitrates. Results include: (1) At both resolutions, DCTune quality is a linear function of bit-rate. (2) DCTune quantization matrices for all images at all bitrates and resolutions are modeled well by an inverse Gaussian, with parameters of amplitude and width. (3) As bit-rate is varied, optimal values of both amplitude and width covary in an approximately linear fashion. (4) Both amplitude and width vary in systematic and orderly fashion with either bit-rate or DCTune quality; simple mathematical functions serve to describe these relationships. (5) In going from 150 to 300 dpi, amplitude parameters are substantially lower and widths larger at corresponding bit-rates or qualities. (6) Visually lossless compression occurs at a DCTune quality value of about 1. (7) At 0.25 bits/pixel, comparative ratings give DCTune a substantial advantage over standard JPEG. As visually lossless bit-rates are approached, this advantage of necessity diminishes. We have concluded that DCTune optimized quantization matrices provide better visual quality than standard JPEG. Meaningful quality levels may be specified by means of the DCTune metric. Optimized matrices are very similar across the class of dental x-rays, suggesting the possibility of a 'class-optimal' matrix. DCTune technology appears to provide some value in the context of compressed dental x-rays.

Author

*Digital Data; Radiography; Video Data; Data Transmission; Video Compression*

**20020039801** NASA Ames Research Center, Moffett Field, CA USA

**Non-Invasive Measurement of Pulsatile Intracranial Pressures Using Ultrasound**

Ueno, Toshiaki, NASA Ames Research Center, USA; Ballard, Richard E., NASA Ames Research Center, USA; Shuer, Lawrence M., Stanford Medical Center, USA; Cantrell, John H., NASA Langley Research Center, USA; Cantrell, John H., NASA Langley Research Center, USA; Hargens, Alan R., NASA Ames Research Center, USA; [1997]; 1p; In English; 10th International Symposium of Intracranial Pressure and Neuromonitoring in Brain Injury, 25-29 May 1997, Williamsburg, VA, USA

Contract(s)/Grant(s): RTOP 199-26-12-38; No Copyright; Avail: Issuing Activity; Abstract Only

Early detection of elevated intracranial pressure (ICP) will aid clinical decision-making for head trauma, brain tumor and other cerebrovascular diseases. Conventional methods, however, require surgical procedures which take time and are accompanied by increased risk of infection. Accordingly we have developed and refined a new ultrasound device to measure skull movements which are known to occur in conjunction with altered ICP. The principle of this device is based upon pulse phase locked loop (PPLL), which enables us to detect changes in distance on the order of microns between an ultrasound transducer on one side of the skull and the opposite inner surface of the cranium. The present study was designed to verify this measurement technique in cadavera. Transcranial distance was increased in steps of 10 mmHg from zero to 50 mmHg by saline infusion into the lateral ventricle of two cadavera. In separate experiments, pulsations of ICP with the amplitudes of zero to 2 mmHg were generated by rhythmic injections of saline using a syringe. When the ICP was stepwise increased from zero to 50 mmHg, transcranial distance increased in proportion with the ICP increase ( $y=12x - 76$ ,  $r=0.938$ ), where  $y$  is changes in transcranial distance in microns and  $x$  is ICP in mmHg. In the data recorded while ICP pulsations were generated, fast Fourier transform analysis demonstrated that cranial pulsations were clearly associated with ICP pulsations. The results indicate that changes in transcranial distance is linearly correlated with those in ICP, and also that the PPLL device has sufficient sensitivity to detect transcranial pulsations which occur in association with the cardiac cycle. By analyzing the magnitude of cranial pulsations, we may be able to estimate the pressure-volume index in the cranium. As a result, estimates of intracranial compliance may be possible by using the PPLL device. Further studies are necessary in normal subjects and patients.

Author

*Intracranial Pressure; Pressure Measurement; Ultrasonic Tests; Intracranial Cavity; Examination*

**20020039833** NASA Johnson Space Center, Houston, TX USA

**Effect of Daily Supine LBNP Exercise on Gastrointestinal Motility During Antiorthostatic Bedrest in Normal Subjects**

Putcha, Lakshmi, NASA Johnson Space Center, USA; DeKerlegand, D., Krug Life Sciences, Inc., USA; [1997]; 1p; In English; Aerospace Medicine Association Meeting, 11-15 May 1997, Chicago, IL, USA

Contract(s)/Grant(s): RTOP 199-26-12-38; No Copyright; Avail: Issuing Activity; Abstract Only

Space flight alters gastrointestinal (GI) function in general, and GI motility, in particular. This can decrease appetite, affect the body's ability to absorb nutrients, fluids and electrolytes, and contribute to a negative energy balance. Antiorthostatic bed rest (ABR) has been used to simulate microgravity-induced physiological changes in human subjects. The objective of this investigation is to determine if daily supine lower body negative pressure (LBNP) exercise will maintain GI motility at near normal levels during ABR. Eight subjects participated in the study protocol consisting of an ambulatory phase scheduled before bedrest periods and two 14 day bed rest (6 deg head-down tilt) periods, once with and another time without exercise. Supine treadmill running in an LBNP chamber was used for exercise. Mouth-to-cecum transit time (MCTT) of lactulose was measured indirectly using the rise in breath hydrogen level after oral administration of lactulose (20 g) following a standard low-fiber breakfast. GI motility during ambulatory and ABR periods was assessed using MCTT data. Results of this Study indicate that GI motility during ABR without exercise decreased by 45% [MCTT +/- S.E.M. 56.2 +/- 6.0 (Ambulatory); 87.3 +/- 8.3 (ABR)]. Supine LBNP exercise did not significantly alter this reduction in GI motility during ABR [MCTT +/- S.E.M. 81.3 +/- 4.2 (Exercise); 87.3 +/- 8.3 (No Exercise)]. These results suggest that supine LBNP exercise may not be an effective countermeasure for microgravity-induced decrements in GI motility and function.

Author

*Bed Rest; Gastrointestinal System; Human Beings; Lower Body Negative Pressure; Orthostatic Tolerance; Physiological Responses*

**20020039834** NASA Ames Research Center, Moffett Field, CA USA

**Operational Issues: What Science is Available?**

Rosekind, Mark R., NASA Ames Research Center, USA; Neri, David F., NASA Ames Research Center, USA; [1997]; 1p; In English; Aerospace Medical and Environmental Medicine Meeting, 12-16 May 1997, Chicago, IL, USA

Contract(s)/Grant(s): RTOP 505-64-53; No Copyright; Avail: Issuing Activity; Abstract Only

Flight/duty/rest considerations involve two highly complex factors: the diverse demands of aviation operations and human physiology (especially sleep and circadian rhythms). Several core operational issues related to fatigue have been identified, such as minimum rest requirements, duty length, flight time considerations, crossing multiple time zones, and night flying. Operations also can involve on-call reserve status and callout, delays due to unforeseen circumstances (e.g., weather, mechanical), and on-demand flights. Over 40 years of scientific research is now available to apply to these complex issues of flight/duty/rest requirements. This research involves controlled 'laboratory studies, simulations, and data collected during regular flight operations. When flight/duty/rest requirements are determined they are typically based on a variety of considerations, such as operational demand, safety, economic, etc. Rarely has the available, state-of-the-art science been a consideration along with these other factors when determining flight/duty/rest requirements. While the complexity of the operational demand and human physiology precludes an absolute solution, there is an opportunity to take full advantage of the current scientific data. Incorporating these data in a rational operational manner into flight/duty/rest requirements can improve flight crew performance, alertness, and ultimately, aviation safety.

Author

*Alertness; Circadian Rhythms; Flight Crews; Flight Safety; Human Performance; Sleep*

**20020039844** NASA Ames Research Center, Moffett Field, CA USA

**Influence of Altered Mass Loading on Testosterone Levels and Testicular Mass**

Wang, Tommy J., NASA Ames Research Center, USA; Ortiz, R. M., NASA Ames Research Center, USA; Wade, C. E., NASA Ames Research Center, USA; [1996]; 1p; In English; FASEB Conference, 6-9 Apr. 1997, New Orleans, LA, USA; Sponsored by Federation of American Societies for Experimental Biology, USA

Contract(s)/Grant(s): RTOP 947-30-60; RTOP 106-20-01-02; No Copyright; Avail: Issuing Activity; Abstract Only

Effects of altered load on testosterone levels and testicular mass in mammals are not well defined. Two separate studies (loading;centrifuged; +2G(sub z) and unloading;hindlimb suspension;HLS) were conducted to provide a better understanding of the effects of mass loading on testosterone levels and testicular mass. Daily urine samples were collected, and testicular mass measured at the end of the study. +2G(sub z): Sprague-Dawley rats (230-250 g) were centrifuged for 12 days at +2G(sub z): 8 centrifuged (EC) and 8 off centrifuge controls (OCC). EC had lower body mass, however relative testicular mass was greater. EC exhibited an increase in excreted testosterone levels between days 2 (T2) and 6 (T6), and returned to baseline at T9. HLS: to assess the effects of unloading Sprague-Dawley rats (125-150 g) were studied for 12 days: 10 suspended (Exp) and 10 ambulatory (Ctl). Exp had lower body mass during the study, with reduced absolute and relative testicular mass. Exp demonstrated lower excreted testosterone levels from T5-T12. Conclusions: Loading appears to stimulate anabolism, as opposed to unloading, as indicated by greater relative testicular mass and excreted testosterone levels. Reported changes in muscle mass during loading and unloading coincide with similar changes in excreted testosterone levels.

Author

*Rats; Loads (Forces); Unloading; Muscles; Mammals*

**20020039861** NASA Ames Research Center, Moffett Field, CA USA

**Forearm Muscle Oxygenation Decreases During Low Levels of Brief, Isometric Contraction**

Murthy Gita, California Univ., USA; Kahan, N. J., NASA Ames Research Center, USA; Hargens, Alan R., NASA Ames Research Center, USA; Rempel, D. M., California Univ., USA; [1997]; 1p; In English; 43rd Orthopaedic Research Society Meeting, 9-13 Feb. 1997, San Francisco, CA, USA

Contract(s)/Grant(s): RTOP 274-51-51-01; No Copyright; Avail: Issuing Activity; Abstract Only

Regional muscle pain syndromes can be caused by repeated and sustained exertion of a specific muscle. Such exertion may elevate local tissue fluid pressure, reduce blood flow and tissue oxygenation (TO2), and cause fatigue, pain and functional deficits of the Involved muscle. Low levels (less than 20% maximum voluntary contraction (MVC)) of prolonged static contraction of the upper extremity are common In many occupational settings and May cause fatigue. The purpose of our Investigation was to determine whether TO2 decreases significantly at low levels of static contraction of the extensor carpi radialis brevis (ECRB). Derived from text

*Signs and Symptoms; Muscles; Pain; Blood Flow*

**20020040388** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Actual and Perceived Cognitive Performance during Acute Altitude Exposure**

Terry, Laura C.; Jan. 2001; 83p; In English

Report No.(s): AD-A399422; AFIT-CI02-32; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Observations by aviators and mountain climbers who attempt to ascend above 10,000 to 14,000 ft will often include references to impairments of cognitive abilities. Although known cognitive impairments occur at altitude, little has been done to research the perception of such decrements in performance. The purpose of this study was to evaluate potential differences in actual and perceived cognitive performance at moderate altitude (10,000 ft and 14,000 ft) under several environmental conditions. Ten subjects were exposed to each altitude condition on separate days and asked to perform a computer test, SYNWIN, while at rest at ground level (5,000 ft), at rest at altitude, after 10 minutes of exercise at altitude, and while breathing supplemental oxygen at altitude. Before and after each test at altitude, subjects were asked to provide pre- and post-test estimates regarding their performance on the cognitive test by rating their performance on a five-point scale, as compared to the most recently completed test. It was hypothesized that cognitive performance at 14,000 ft would be worse than that at 10,000 ft, with the difference exacerbated after exercise, but then eliminated by supplemental oxygen. It was also hypothesized that over-confidence would also manifest itself, to degrees corresponding to the hypothesized decrements in performance. Actual performance on the test was significantly greater at 10,000 ft compared to both ground level and 14,000 ft while at rest. Performance at 10,000 ft was also significantly greater than that at 14,000 ft after exercise and oxygen supplementation. Post-exercise scores were significantly greater than pre-exercise scores, regardless of altitude. Performance while breathing supplemental oxygen was significantly greater than without oxygen, also regardless of altitude.

DTIC

*Cognition; Physiological Effects; Mental Performance; Cognitive Psychology*

**20020040389** RAND Corp., Santa Monica, CA USA

**RESEARCH HIGHLIGHTS: After 9/11: Stress and Coping Across America**

Jan. 2001; 4p; In English

Report No.(s): AD-A399418; RB-4546; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

As survivors of natural disasters, violent crimes, and war attest, people who are victims or witnesses of a traumatic event often experience symptoms of stress, sometimes for years after. But events in recent years have taught us that individuals need not be present at a catastrophic event to experience stress symptoms. The terrorist attacks that shook the USA on September 11, 2001 were immediately broadcast on TV screens across the nation. Remarkable video footage that showed the events and their aftermath in graphic detail was repeatedly aired after the attacks. Many Americans may have identified with the victims or perceived the unprecedented attacks as directed at themselves as well. Thus, even people who were nowhere near the locations of the attacks might have experienced substantial stress responses.

DTIC

*Stress (Psychology); Terrorism; USA*

**20020040846** NASA Ames Research Center, Moffett Field, CA USA

**Perceptual Image Compression in Telemedicine**

Watson, Andrew B., NASA Ames Research Center, USA; Ahumada, Albert J., Jr., NASA Ames Research Center, USA; Eckstein, Miguel, Cedars-Sinai Medical Center, USA; [1996]; 1p; In English; Technology 2006, Telemedicine Workshop, 29-31 Oct. 1996, Unknown

Contract(s)/Grant(s): RTOP 199-06-12; No Copyright; Avail: Issuing Activity; Abstract Only

The next era of space exploration, especially the "Mission to Planet Earth" will generate immense quantities of image data. For example, the Earth Observing System (EOS) is expected to generate in excess of one terabyte/day. NASA confronts a major technical challenge in managing this great flow of imagery: in collection, pre-processing, transmission to earth, archiving, and distribution to scientists at remote locations. Expected requirements in most of these areas clearly exceed current technology. Part of the solution to this problem lies in efficient image compression techniques. For much of this imagery, the ultimate consumer is the human eye. In this case image compression should be designed to match the visual capacities of the human observer. We have developed three techniques for optimizing image compression for the human viewer. The first consists of a formula, developed jointly with IBM and based on psychophysical measurements, that computes a DCT quantization matrix for any specified combination of viewing distance, display resolution, and display brightness. This DCT quantization matrix is used in most recent standards for digital image compression (JPEG, MPEG, CCITT H.261). The second technique optimizes the DCT quantization matrix for each individual image, based on the contents of the image. This is accomplished by means of a model of visual sensitivity to compression artifacts. The third technique extends the first two techniques to the realm of wavelet compression. Together these two techniques will allow systematic perceptual optimization of image compression in NASA imaging systems. Many of the image management challenges faced by NASA are mirrored in the field of telemedicine. Here too there are severe demands for transmission and archiving of large image databases, and the imagery is ultimately used primarily

by human observers, such as radiologists. In this presentation I will describe some of our preliminary explorations of the applications of our technology to the special problems of telemedicine.

Author

*Video Compression; Imagery; Telemedicine; Imaging Techniques; Space Exploration*

## 53

### BEHAVIORAL SCIENCES

*Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.*

**20020039425** Institute for Human Factors TNO, Soesterberg, Netherlands

**Perception of Unusual Attitudes Final Report Waameming Van Ongewone Houdingen**

Groen, E. L., Institute for Human Factors TNO, Netherlands; Dec. 31, 2001; 11p; In Dutch

Contract(s)/Grant(s): 013.60043.01.03; TNO Proj. 789.3

Report No.(s): TD-2001-0354; TM-01-B011; Copyright; Avail: Issuing Activity

The purpose of this study was to investigate whether the relative weighting between visual and non-visual orientation cues depends on the body orientation. Supine subjects may perceive themselves in an upright posture when a furnished experimental room is tilted 90 deg so that the visual polarity axis is kept aligned with the subject's body. This 'upright illusion' was used to examine whether roll tilt of the subject about a vertical axis can induce illusory self tilt about a perceptually horizontal axis. The results were compared with lateral tilt of subjects or room about a truly horizontal axis. Perceived self tilt was indicated with a joystick. Six out of ten subjects experienced the upright illusion. Their data showed that visual orientation cues are weighted twice as strong as vestibular orientation cues. The exception to this was the situation in which both subject and room were synchronously filled sideways. In that situation visual cues were assigned a weight of six. The contribution of visual cues to gravity was independent of the subject's orientation to gravity itself, but did depend on the relative orientation between the visual axis and the body axis.

Author

*Attitude (Inclination); Cues; Visual Stimuli*

**20020039477** NASA Ames Research Center, Moffett Field, CA USA

**From Aeronautics to Space: Lessons in Human Automation**

Connors, Mary M., NASA Ames Research Center, USA; [1996]; 1p; In English; AIAA/Space Programs and Technology, 24-26 Sep. 1996, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 538-04-11; No Copyright; Avail: Issuing Activity; Abstract Only

Civilian air flight continues on a growth curve, as more and more people utilize air travel to meet business and personal travel needs: This consumer-driven demand has resulted in the adoption of new methods to increase air system capacity and to make the air transportation system increasingly more efficient. As a consequence, civilian aviation, as an industry, has assumed a leading role in the use of automated systems, and, by implication, in the understanding of how human operators interact with these systems. Aeronautical automation systems serve a variety of roles. These include controlling aircraft and aiding, advising and monitoring numerous functions in the aircraft/airspace system. Experiences in the use of human/automation systems gathered from aviation are, in many cases, generalizable to other industries having similar requirements for human and non-human intelligent system interaction. However, the human/automation lessons learned from aviation have special relevance to the space application, where many of the same operational demands prevail. The application of aeronautical lessons of human-automated interaction to spaceflight is the subject of this paper. The discussion will address: the progress that has been made through aeronautically-based research and experience in understanding human/automation interaction, ways that this understanding can be applied to the needs of space, and the limits of our present understanding of human/automations systems. Suggestions will be offered related to human-automation research generally, and to the particular needs of the space endeavor.

Author

*Automatic Control; Air Transportation; Space Flight; Airspace*

**20020039613** NASA Ames Research Center, Moffett Field, CA USA

**Effect of Spaceflight on Vestibulo-Ocular Reflexes (VORS) During Angular Head Motion**

Tomko, David L., NASA Ames Research Center, USA; Clifford, James O., Lockheed Martin Engineering and Sciences Co., USA; [1996]; 1p; In English; 26th Annual Meeting of the Society for Neuroscience, 16-21 Nov. 1996, Washington, DC, USA; Sponsored by Society for Neuroscience, USA

Contract(s)/Grant(s): RTOP 199-16-12-23; RTOP 199-16-12-24; RTOP 106-30-04-40; No Copyright; Avail: Issuing Activity; Abstract Only

Vestibulo-ocular reflexes (VORs) stabilize the eyes during head motion. During Earth-horizontal (E-H) pitch or roll rotations, canal and otolith stimuli occur together. In Earth-vertical (E-V) pitch or roll rotations, only canal signals occur. In cats and squirrel monkeys, pitch/roll VOR gains during E-H motion have been shown to be larger than during E-V motion, implying that otolith modulation plays a role in producing angular VORs (aVORs). The present experiments replicated this experiment in rhesus monkeys, and examined how spaceflight affected AVOR gain. During yaw, pitch and roll (0.5 - 1.0 Hz, 40-50 deg/s pk) motion, 3-d eye movements were recorded in four Rhesus monkeys using scleral search coils. Mean E-H and E-V pitch VOR gains were 0.85 and 0.71. Torsional VOR gains during E-H and E-V were 0.47 and 0.39. Gains are more compensatory during E-H pitch or roll. Two of the four monkeys flew for 11 days on the COSMOS 2229 Biosatellite. E-H pitch VOR gains were attenuated immediately (72 hrs) post-flight, with similar values to pre-flight E-V pitch gains. Horizontal yaw VOR gains were similar pre- and post-flight.

Author

*Otolith Organs; Roll; Physiological Effects; Reflexes; Attitude (Inclination)*

**20020039720** Institute for Human Factors TNO, Soesterberg, Netherlands

**The Role of Emotions in Complex Decision Tasks Final Report De Rol Van Emoties in Complexe Beslistaken**

Kerstholt, J. H., Institute for Human Factors TNO, Netherlands; deKok, H. J., Institute for Human Factors TNO, Netherlands; Dec. 17, 2001; 18p; In English

Contract(s)/Grant(s): 013.60012; TNO Proj. 787.1

Report No.(s): TD-2001-0349; TM-01-8009; Copyright; Avail: Issuing Activity

Decision making research has primarily focussed on the cognitive aspects of the decision making process: how do people make decisions on the basis of information available and which errors are made? Particularly in Interpersonal judgments, however, emotions come into play as well. Seeing a person can trigger a schema (a stereotype). This schema represents both knowledge and feelings towards a particular group. In the present study we investigated to what extent emotions are used to reduce task complexity. As the use of stereotypic information requires only limited information processing capacity, In contrast to the integration of factual information, It is expected that decision makers rely more on their emotions when the interpersonal judgments are more complex. Participants had to select an applicant for a job vacancy. Set size was manipulated: the number of applicants was either 9, 36 or 81. Preceding their choice, participants could either request the applicants' picture or their curriculum vitae. Use of picture information was taken as an indication for the emotional component in the decision making process and use of information from the curriculum vitae as an indication for the rational component in the decision making process. In the biggest choice set (81 applicants) participants most often consulted both CV and picture, In the moderate choice set (36 applicants) participants most often looked at the CV only and in the smallest set (9 applicants) both strategies were equally often used. Even though previous research has indicated that less information is requested when task complexity increases, we showed that more information was used. This could imply that picture information reduces the complexity of the choice process. However, by means of regression analysis we could not indicate that the actual choices were based on picture information. Reduction of set size could be well explained by information from the curriculum vitae. The eventual choice for a female applicant could also be explained by information from the curriculum vitae, but not the eventual choice for a male applicant. Perhaps emotions do, in the sense of "a stereotypical scientist", play a larger role in choosing a man than a woman. Even though we have some indication that people do not only use information from the curriculum vitae in choosing a man, it is not clear whether it reflects an emotional component. It is therefore recommended to incorporate a physiological measurement in follow up research. Furthermore, the method that has been used, better fits a cognitive decision model than an affective one. As people have to choose for a specific kind of information they might be induced to use a rational decision process. In all, it would be fruitful to register eye movements in a follow up experiment. First, participants are not forced to deliberately choose a picture and, second, it allows for the registration of pupil diameter (a physiological reaction).

Author

*Emotional Factors; Emotions; Decision Making; Judgments; Human Reactions*

**20020039823** NASA Ames Research Center, Moffett Field, CA USA

**Eye Movements Reveal Hierarchical Motion Processing**

Mulligan, Jeffrey B., NASA Ames Research Center, USA; [1996]; 1p; In English

Contract(s)/Grant(s): RTOP 505-64-53; RTOP 199-06-12-31; No Copyright; Avail: Issuing Activity; Abstract Only

Purpose: In the analysis of visual motion, local features such as orientation are analyzed early in the cortical processing stream (V1), while integration across orientation and space is thought to occur in higher cortical areas such as MT, MST, etc. If all areas

provide inputs to eye movement control centers, we would expect that local properties would drive eye movements with relatively short latencies, while global properties would require longer latencies. When such latencies are observed, they can provide information about when (and where?) various stimulus properties are analyzed. Methods: The stimulus employed was an elliptical Gabor patch with a drifting carrier, in which the orientations of the carrier grating and the contrast window were varied independently. We have previously demonstrated that the directional percepts evoked by this stimulus vary between the "grating direction" (the normal to the grating's orientation) and the "window direction", and that similar effects can be observed in reflexive eye movements. Subjects viewed such a stimulus while attempting to maintain steady fixation on the center of the pattern, and the small reflexive eye movements ("stare OKN") were recorded. In the middle of the trial, the orientation of either the grating or the window was rotated smoothly by 30 degrees. Results: Responses to the shift of both grating orientation and window orientation are seen in the average OKN slow phase velocity. Grating rotations produce a rapid OKN rotation to the grating direction (100 ms latency, 300 ms time constant), followed by a slower rebound to the steady state perceived direction midway between the grating and window directions. Window rotations, on the other hand, evoke a slower response (200 ms latency, 500 ms time constant). Conclusions: The results demonstrate multiple cortical inputs to eye movement control: a fast, early input driven by orientation, and a slower input from higher areas sensitive to global stimulus properties.

Author

*Eye Movements; Visual Discrimination; Rotation*

**20020039847** NASA Ames Research Center, Moffett Field, CA USA

**Eye Movement Latencies to Direction Change for Different Classes of Motion**

Mulligan, Jeffrey B., NASA Ames Research Center, USA; [1997]; 1p; In English; Twenty-Second Annual Interdisciplinary Conference, 2-7 Feb. 1997, Jackson Hole, WY, USA

Contract(s)/Grant(s): RTOP 505-64-53; RTOP 199-06-12-31; No Copyright; Avail: Issuing Activity; Abstract Only

In the analysis of visual motion, local features such as orientation are analyzed early in the cortical processing stream (V1), while integration across orientation and space is thought to occur in higher cortical areas such as MT, MST, etc. If all areas provide inputs to eye movement control centers, we would expect that local properties would drive eye movements with relatively short latencies, while global properties would require longer latencies. When such latencies are observed, they can provide information about when (and where?) various stimulus properties are analyzed. to this end, a stimulus was employed in which local and global properties determining perceived direction-of-motion could be manipulated independently: an elliptical Gabor patch with a drifting carrier, with variable orientation of the carrier grating and the contrast window. We have previously demonstrated that the directional percepts evoked by this stimulus vary between the "grating direction" (the normal to the grating's orientation) and the "window direction" (ARVO 91, 94), and that similar effects can be observed in reflexive eye movements (ARVO 95). Subjects viewed such a stimulus while attempting to maintain steady fixation on the center of the pattern, and the small reflexive eye movements ("stare OKN") were recorded. In the middle of the trial, the orientation of either the grating or the window was rotated smoothly by 30 degrees. Responses to the shift of both grating orientation and window orientation are seen in the average OKN slow phase velocity. Grating rotations produce a rapid OKN rotation to the grating direction (100 ms latency, 300 ms time constant), followed by a slower rebound to the steady state perceived direction midway between the grating and window directions. Window rotations, on the other hand, evoke a slower response (200 ms latency, 500 ms time constant). The results demonstrate multiple cortical inputs to eye movement control: a fast early input driven by orientation, and a slower input from higher areas sensitive to global stimulus properties.

Author

*Eye Movements; Steady State; Rotation; Time Constant; Motion*

**20020040338** Dynamics Research Corp., Wilmington, MA USA

**Development of Candidate Crew Coordination Training Methods and Materials Final Report, 10 Feb. -31 Oct. 1992**

Pawlik, Eugene A., Sr.; Simon, Robert; Grubb, G.; Zeller, J.; Apr. 1993; 119p; In English

Contract(s)/Grant(s): MDA-903-92-D-0025

Report No.(s): AD-A399518; DRC-E-21983U; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This technical report covers the development of aircrew coordination training methods and materials for the USA Army. The development of two Aircrew Coordination Exportable Training Packages, candidate and final, is discussed. The candidate Aircrew Coordination Exportable Training Package was developed to provide an illustrative context for the field validation of a prototype methodology for training and evaluating Army aircrew coordination skills in the helicopter cockpit. Development of the field exportable evaluation package is discussed in a companion report. Lessons learned from the field validation testbed were then used to develop the final Aircrew Coordination Exportable Training Package. The report concludes by providing

recommendations for the improvement, fielding, and use of the Army Aviation Aircrew Coordination Exportable Training Package, which was provided separately to ARI in a companion report.

DTIC

*Education; Flight Crews; Armed Forces (USA)*

**20020040845** NASA Ames Research Center, Moffett Field, CA USA

**The Role of Response Processing in the Single-Channel PRP Bottleneck**

VanSelst, Mark, NASA Ames Research Center, USA; Johnston, James, NASA Ames Research Center, USA; [1996]; 1p; In English; 37th Annual Meeting of the Psychonomic Society, 31 Oct. - 3 Nov. 1996, Chicago, IL, USA; Sponsored by Psychonomic Society, USA

Contract(s)/Grant(s): RTOP 199-06-12; No Copyright; Avail: Issuing Activity; Abstract Only

Does the single-channel bottleneck occur in the psychological refractory period paradigm in the absence of overt responses? A go/no-go paradigm was used to vary a default response on all trials, multiple go responses were used. Results show that the bottleneck is still present on trials that do not require a response, but its duration is reduced.

Author

*Refractory Period; Reaction Time*

**20020040848** NASA Ames Research Center, Moffett Field, CA USA

**Moving Through Time: The Utility of a Temporal Metric for Vehicular Control**

Kaiser, Mary K., NASA Ames Research Center, USA; [1996]; 1p; In English; 9th International Conference on Perception and Action, 20-25 Jul. 1997, Scarborough, Canada

Contract(s)/Grant(s): RTOP 199-06-12; No Copyright; Avail: Issuing Activity; Abstract Only

Recent work on time-to-contact (TTC) and time-to-passage (TTP) estimation have revealed conflicting evidence. On the one hand, when tau information is available, observers often fail to use it properly. For instance, absolute size of the object, rotation, and contrast all interfere with estimation accuracy. That is, the visual system often is unable to isolate tau. On the other hand, judgments are remarkably robust when invariant information is no longer available. Observers seem to adjust to many disturbances. This symposium intends to stimulate a discussion of recent findings within visual and auditory TTC paradigms. Alternative concepts that are able to accommodate these findings should be entertained and, if found valid, incorporated into the classic theory of temporal-range estimation.

Author

*Temporal Resolution; Visual Perception; Visual Control*

**20020040901** NASA Ames Research Center, Moffett Field, CA USA

**Tracking Virtual Trajectories**

Stone, Leland S., NASA Ames Research Center, USA; Beutter, Brent R., NASA Ames Research Center, USA; Lorenceau, Jean D., NASA Ames Research Center, USA; [1996]; 1p; In English

Contract(s)/Grant(s): RTOP 199-16-12-37; No Copyright; Avail: Issuing Activity; Abstract Only

Current models of smooth pursuit eye movements assume that it is largely driven by retinal image motion. We tested this hypothesis by measuring pursuit of elliptical motion (3.2s, 0.9 Hz, 1.4 deg x 1.6 deg, 4 randomly interleaved phases) of either a small spot ("real" motion) or of a line-figure diamond viewed through apertures such that only the motion of four isolated oblique line segments was visible ("virtual" motion). Each segment moved sinusoidally along a linear trajectory yet subjects perceived a diamond moving along an elliptical path behind the aperture. We found, as expected, that real motion produced accurate tracking ( $N = 2$ ) with mean gain (over horizontal and vertical) of 0.9, mean phase of -6 deg (lag), mean relative phase (H vs V) of 90 +/- 8 deg (RMS error). Virtual motion behind an X-shaped aperture ( $N = 4$  with one naive) yielded a mean gain of 0.7, mean phase of -11 deg, mean relative phase of 87 +/- 15 deg. We also measured pursuit with the X-shaped aperture using a higher segment luminance which prevents the segments from being grouped into a coherently moving diamond while keeping the motion otherwise identical. In this incoherent case, the same four subjects no longer showed consistent elliptical tracking (RMS error in relative phase rose to 60 deg) suggesting that perceptual coherence is critical. Furthermore, to rule out tracking of the centroid, we also used vertical apertures so that all segment motion was vertical ( $N = 3$ ). This stimulus still produced elliptical tracking (mean relative phase of 84 +/- 19 deg), albeit with a lower gain (0.6). These data show that humans can track moving objects reasonably accurately even when the trajectory can only be derived by spatial integration of motion signals. Models that merely seek to minimize retinal or local stimulus motion cannot explain these results.

Author

*Trajectories; Eye Movements; Retinal Images; Visual Perception*

**20020040906** NASA Ames Research Center, Moffett Field, CA USA

**Expectancy and Repetition in Task Preparation**

Ruthruff, E., NASA Ames Research Center, USA; Remington, R. W., NASA Ames Research Center, USA; Johnston, James C., NASA Ames Research Center, USA; [1996]; 1p; In English; 37th Annual Meeting of the Psychonomic Society, 31 Oct. - 3 Nov. 1996, Chicago, IL, USA; Sponsored by Psychonomic Society, USA

Contract(s)/Grant(s): RTOP 199-06-12; No Copyright; Avail: Issuing Activity; Abstract Only

We studied the mechanisms of task preparation using a design that pitted task expectancy against task repetition. In one experiment, two simple cognitive tasks were presented in a predictable sequence containing both repetitions and non-repetitions. The typical task sequence was AABBAABB. Occasional violations of this sequence allowed us to measure the effects of valid versus invalid expectancy. With this design, we were able to study the effects of task expectancy, task repetition, and interaction.

Author

*Mental Performance; Tasks*

**54**

**MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT**

*Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..*

**20020039141** Institute for Human Factors TNO, Soesterberg, Netherlands

**Effect of Timing Parameters on the Vibrotactile Spatial Acuity of the Torso *Interim Report***

vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; Nov. 05, 2001; 7p; In English; Original contains color illustrations

Contract(s)/Grant(s): 013.31307; TNO Proj. 788.1

Report No.(s): TD-2001-0168; TM-01-A061; Copyright; Avail: Issuing Activity

A psychophysical experiment gives insight into the effect of timing parameters on the vibrotactile spatial acuity of the back. The faster presentation of stimuli results in a higher processing capacity than placing stimuli closer together.

Author

*Torso; Touch; Skin (Anatomy); Sensory Stimulation*

**20020039536** NASA Langley Research Center, Hampton, VA USA

**Research on Hazardous States of Awareness and Physiological Factors in Aerospace Operations**

Prinzel, Lawrence J., III, NASA Langley Research Center, USA; March 2002; 88p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 711-50-21-01

Report No.(s): NASA/TM-2002-211444; L-18149; NAS 1.15:211444; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The technical memorandum describes research conducted to examine the etiologies and nature of hazardous states of awareness and the psychophysiological factors involved in their onset in aerospace operations. A considerable amount of research has been conducted at NASA that examines psychological and human factors issues that may play a role in aviation safety. The technical memorandum describes some of the research that was conducted between 1998 and 2001, both in-house and as cooperative agreements, which addressed some of these issues. The research was sponsored as part of the physiological factors subelement of the Aviation Operation Systems (AOS) program and Physiological / Psychological Stressors and Factors project. Dr. Lance Prinzel is the Level III subelement lead and can be contacted at l.j.prinzel@larc.nasa.gov.

Author

*Physiological Factors; Psychological Factors; Aerospace Safety; Situational Awareness*

**20020039552** NASA Johnson Space Center, Houston, TX USA

**Plant Production Systems for Microgravity: Critical Issues in Water, Air, and Solute Transport Through Unsaturated Porous Media**

Steinberg, Susan L., Editor, Liberated Technical, USA; Ming, Doug W., Editor, NASA Johnson Space Center, USA; Henninger, Don, Editor, NASA Johnson Space Center, USA; February 2002; 78p; In English, 24-25 Jul. 2000, Houston, TX, USA

Report No.(s): NASA/TM-2002-210774; S-884; NAS 1.15:210774; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This NASA Technical Memorandum is a compilation of presentations and discussions in the form of minutes from a workshop entitled 'Plant Production Systems for Microgravity: Critical Issues in Water, Air, and Solute Transport Through Unsaturated Porous Media' held at NASA's Johnson Space Center, July 24-25, 2000. This workshop arose from the growing belief within NASA's Advanced Life Support Program that further advances and improvements in plant production systems for microgravity would benefit from additional knowledge of fundamental processes occurring in the root zone. The objective of the workshop was to bring together individuals who had expertise in various areas of fluid physics, soil physics, plant physiology, hardware development, and flight tests to identify, discuss, and prioritize critical issues of water and air flow through porous media in microgravity. Participants of the workshop included representatives from private companies involved in flight hardware development and scientists from universities and NASA Centers with expertise in plant flight tests, plant physiology, fluid physics, and soil physics.

Author

*Plants (Botany); Gravitational Effects; Microgravity; Porosity*

**20020039642** NASA Ames Research Center, Moffett Field, CA USA

**A Cross-Industry Analysis of LOFT Debriefings**

Dismukes, Key, NASA Ames Research Center, USA; [1996]; 1p; In English; AQP Working Group, 28-29 May 1996, Minneapolis, MN, USA

Contract(s)/Grant(s): RTOP 505-64-13; No Copyright; Avail: Issuing Activity; Abstract Only

Line Oriented Simulation (LOS) is widely used to provide crews opportunities to practice Cockpit Resource Management (CRM) concepts in realistic, challenging simulated flight situations. LOS includes both Line Oriented Flight Training (LOFT), the original "non-jeopardy" form in which the crews are not graded on their performance, and Line Oriented Evaluation (LOE). In LOE, crews are graded, which is required in those airlines that participate in the FAA's Advanced Qualification Program (ALP). How much crews learn in LOS and take back to the line hinges on the effectiveness of the debriefing that follows the LOS. The simulation itself is a busy, intense experience, and thoughtful discussion afterwards is necessary for the crew to sort out and interpret what happened and why. Instructors are expected to lead briefings in a way that encourages crew members to analyze for themselves their performance in the LOS. Rather than lecturing the crew in the traditional manner on what they did right and wrong, the instructor is expected to facilitate self-discovery and self-critique by the crew. We have recently completed a study in which we observed 36 LOFT briefings at 5 major U.S. airlines. We audiotape recorded the briefings, transcribed the recordings, and coded for more than 70 variables. Our analysis addresses four broad questions: to what extent do instructors attempt to facilitate crew self-analysis? What techniques do instructors use to facilitate and how effective are these techniques? What is the character of crew participation? to what extent do briefings emphasize CRM and crew performance? We discuss the implications of our findings for ALP and LOE.

Author

*Flight Crews; Flight Training; Human Performance; Civil Aviation*

**20020040808** Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada

**Thermal Resistance of Inflatable and Non-Inflatable Floors of One-Man Life Rafts for the CF-188 Escape System**

Ducharme, M. B.; Jul. 2001; 25p; In English; Original contains color images

Report No.(s): AD-A399681; DCIEM-TR-2001-125; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this study was to define, using humans as heat source, the difference in thermal resistance of inflatable and non-inflatable floors of one-man life rafts for the CF 188 Escape System of the Canadian Forces. Three life rafts were tested: two with an inflatable floor and one with a non-inflatable floor. Eight subjects of both genders were used to evaluate the thermal resistance of the floors because humans provide adequate heat transfer and pressure on the floors of the life rafts. Skin heat flow and temperatures were recorded from 4 sites on each subject, namely the right and left buttocks and the right and left calves. The results were averaged from the last 10 min of the 1-hour immersion in 5 degrees centigrade water. The results showed that on average, the skin heat loss and temperatures for the four sites were respectively lower by 33% (74 W/m<sup>2</sup>) and higher by 12 degrees centigrade for the inflatable floors as compared to the non-inflatable floors. This resulted in a floor thermal resistance 10 to 12 times higher for the inflatable floors (0.71 + 0.25 and 0.60 + 0.16 Clo) as compared to the non-inflatable floor (0.06 + 0.01 Clo). In conclusion, a life raft with an inflatable floor will significantly reduce the heat loss and the likelihood of developing hypothermia during deployment in cold water when compared to a life raft with a non-inflatable floor.

DTIC

*Escape Systems; Thermal Resistance*

**20020040880** Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA

**Measurement Properties of a Self-Report Index of Ergonomic Exposures for Use in an Office Work Environment**

Dane, Dane J.; Feuerstein, Michael; Huang, Grant D.; Dimberg, Lennart; Ali, Danielle; Feb. 19, 2002; 38p; In English  
Report No.(s): AD-A399366; AFIT-CI02-20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Office work-related upper extremity symptoms and disorders have been associated with static work posture, repetition, and inadequate recovery in the anatomic structures of the neck and upper extremities. Despite these associations there is relatively little research on the development of practical measures of these ergonomic exposures. The present study examines the measurement properties of an upper-extremity specific self-report index of ergonomic exposures. Ninety-two symptomatic office workers completed a web-based questionnaire measuring demographic variables, ergonomic exposures, pain, job stress, and functional limitations. Comparisons of internal consistency, construct validity, and discriminative and predictive abilities were made between the self-report index and an observational exposure assessment checklist. Results indicated that the self-report index had acceptable measurement properties. Furthermore, higher levels of self-reported ergonomic exposures were associated with upper extremity pain, symptom severity, and functional limitations. In contrast, higher levels of observed exposure were only related to lower levels of general physical function. The self-report measure has potential for use in occupational health surveillance programs for office work environments and as an outcome measure of ergonomic exposure in intervention trials. These results also suggest the need for utilizing multiple methods when assessing ergonomic exposures.

DTIC

*Exposure; Signs and Symptoms; Human Factors Engineering; Neck (Anatomy); Stress (Physiology)*

**20020040905** NASA Ames Research Center, Moffett Field, CA USA

**Operational Characteristics of Two Commercially Available Personal Cooling Vests**

Ku, Yu-Tsuan E., Lockheed Martin Engineering and Sciences Co., USA; Lee, Hank C., Lockheed Martin Engineering and Sciences Co., USA; Montgomery, Leslie D., Lockheed Martin Engineering and Sciences Co., USA; Webbon, Bruce W., NASA Ames Research Center, USA; [1996]; 1p; In English; Aerospace Medical Association 1997 Annual Scientific Meeting, 11-15 May 1997, Chicago, IL, USA; Sponsored by Aerospace Medical Association, USA

Contract(s)/Grant(s): RTOP 199-61-99; No Copyright; Avail: Issuing Activity; Abstract Only

Personal thermoregulatory systems which provide chest cooling are used in the industrial and aerospace environments to alleviate thermal stress. However, little information is available regarding the physiologic and circulatory changes produced by routine operation of these systems. The objectives of this study were to compare the effectiveness of two passive cooling vests, and to measure the body temperature and circulatory changes produced by each cooling vest configuration. A Life Enhancement Technologies, (LET) ice vest garment and a Steele, Inc. vest were used to cool the chest region of 11 male subjects (25 to 55 yr) in this study. Calf, forearm and finger blood flows were measured using a tetrapolar impedance rheograph. The subjects, seated in an upright position at normal room temperature (approximately 21 C) were tested for 60 min. with the cooling system operating at its maximum cooling capacity. Blood flows were recorded continuously using a computer data acquisition system with a sampling frequency of 250 Hz. Oral, right and left ear temperatures and cooling system parameters were logged manually every 5 min. Arm, leg, chest and rectal temperatures; heart rate; respiration; and an activity index were recorded continuously on a U.F.I., Inc. Biolog ambulatory monitor. No significant differences were found in either the oral or ear temperature responses to the two vests. However, the rectal and mean skin temperatures at the end of the cooling period were both significantly lower (P less than 0.05), approximately 0.2 and 1.9 C, respectively for the LET vest than for the Steele garment. These data show that different vest configurations may produce different thermal responses in healthy male subjects which should be considered in the use of these cooling garments.

Author

*Cooling; Vests; Thermoregulation; Physiological Responses; Blood Circulation; Body Temperature*

## 55

### EXO BIOLOGY

*Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see 52 Aerospace medicine; on animals and plants see 51 Life Sciences. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science.*

**20020039737** NASA Ames Research Center, Moffett Field, CA USA

**Exploring for Martian Life**

Farmer, Jack D., NASA Ames Research Center, USA; [1997]; 1p; In English; American Astronomical Society Conference, 12-16

Jan. 1996, Toronto, Canada; Sponsored by American Astronautical Society, USA

Contract(s)/Grant(s): RTOP 344-38-32; Copyright; Avail: Issuing Activity; Abstract Only

Terrestrial life appears to have arisen very quickly during late accretion, sometime between approximately 3.5 and 4.2 Ga. During this same time, liquid water appears to have been abundant at the surface of Mars and it is quite plausible that life originated there as well. We now believe that the last common ancestor of terrestrial life was a sulfur-metabolizing microbe that lived at high temperatures. Rooting of the RNA tree in thermophily probably reflects high temperature "bottle-necking" of the biosphere by giant impacts during late accretion, sometime after life had originated. If high temperature bottle-necking is a general property of early biosphere development, Martian life may have also developed in close association with hydrothermal systems. Several independent lines of evidence suggest that hydrothermal processes have played an important role during the geological history of Mars. Because hydrothermal deposits on Earth are known to capture and retain abundant microbial fossil information, they are considered prime targets in the search for an ancient Martian biosphere. An important step in planning for future landed missions to Mars is the selection of priority targets for high resolution orbital mapping. Geotectonic terranes on Mars that provide a present focus for ongoing site selection studies include channels located along the margins of impact crater melt sheets, or on the slopes of ancient Martian volcanoes, chaotic and fretted terranes where shallow subsurface heat sources are thought to have interacted with ground ice, and the floors of calderas and rifted basins. Orbital missions in 1996, 1998 and 2001 will provide opportunities for high resolution geological mapping at key sites in such terranes, as a basis for selecting targets for future landed missions for exopaleontology.

Author

*Exobiology; Mars (Planet); Mars Exploration; Mars Surface; Microorganisms; Hydrothermal Systems*

**20020040842** NASA Ames Research Center, Moffett Field, CA USA

**The NASA Exobiology Programme**

DesMarais, David J., NASA Ames Research Center, USA; [1996]; 1p; In English; Royal Society Conference, 30 Oct. - 2 Nov. 1996, London, UK; Sponsored by Royal Society, UK

Contract(s)/Grant(s): RTOP 185-52-32; Copyright; Avail: Issuing Activity; Abstract Only

NASA will indeed conduct a more active search for life beyond Earth. Research on the Martian meteorites will be augmented by \$2 million to be contributed equally by NASA and NSF (National Science Foundation). The science strategy for the NASA Mars Surveyor Program now places a much higher priority on the search for life, particularly fossil evidence. This program features two launches per opportunity (every two years, starting this November). The focus on Exobiology emphasizes high resolution multispectral orbital mapping to locate key aqueous sedimentary minerals, the exploration of ancient terrains by capable rovers, and the need for multiple sample return missions. Additional information is contained within the original extended abstract.

Author

*Exobiology; Fossils; Extraterrestrial Life; Space Exploration*

**20020040875** NASA Ames Research Center, Moffett Field, CA USA

**Searching for Life: Early Earth, Mars and Beyond**

DesMarais, David J., NASA Ames Research Center, USA; [1996]; 1p; In English; Royal Society Conference, 30 Oct. - 2 Nov. 1996, London, UK; Sponsored by Royal Society, UK

Contract(s)/Grant(s): RTOP 185-52-32; Copyright; Avail: Issuing Activity; Abstract Only

We might be entering a golden age for exploring life throughout time and space. Rapid gene sequencing will better define our most distant ancestors. The earliest geologic evidence of life is now 3.8 billion years old. Organic matter and submicron-sized morphologies have been preserved in the martian crust for billions of years. Several new missions to Mars are planned, with a high priority on the search for life, past or present. The recent discovery of large extrasolar planets has heightened interest in spacecraft to detect small, earth-like planets. A recent workshop discussed strategies for life detection on such planets. There is much to anticipate in the near future.

Author

*Extraterrestrial Life; Exobiology; Detection; Space Exploration*

## MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

*Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see categories 60 through 67.*

**20020040339** Booz-Allen and Hamilton, Inc., McLean, VA USA

### **A Comparison of the Security Requirements for Cryptographic Modules in FIPS 140-1 and FIPS 140-2**

Snouffer, Ray; Lee, Annabelle; Oldenhoeft, Arch; Jun. 2001; 30p; In English

Report No.(s): AD-A399528; NIST-SP-800-29; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Federal agencies, industry, and the public now rely on cryptography to protect information and communications used in critical infrastructures, electronic commerce, and other application areas. Cryptographic modules are implemented in these products and systems to provide cryptographic services such as confidentiality, integrity, non-repudiation and identification and authentication. Adequate testing and validation of the cryptographic module against established standards is essential for security assurance. Both Federal agencies and the public benefit from the use of tested and validated products. Without adequate testing, weaknesses such as poor design, weak algorithms, or incorrect implementation of the cryptographic module, can result in insecure products.

DTIC

*Cryptography; Modules; Algorithms; Computer Information Security*

**20020040855** Center for Mathematics and Computer Science, Amsterdam Netherlands

### **Performance Criteria for Graph Clustering and Markov Cluster Experiments**

van Dongen, S.; May 2000; 42p

Report No.(s): PB2002-103034; INS-R0012; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

A cluster algorithm for graphs was introduced called the Markov cluster algorithm or MCL algorithm. The algorithm is based on simulation of (stochastic) flow in graphs by means of alternation of two operators, expansion and inflation. The results establish an intrinsic relationship between the corresponding algebraic process (MCL process) and cluster structure in the iterands and the limits of the process. Several kinds of experiments conducted with the MCL algorithm are described here. Test cases with varying homogeneity characteristics are used to establish some of the particular strengths and weaknesses of the algorithm.

NTIS

*Algorithms; Graph Theory; Operators (Mathematics); Markov Processes*

**20020040857** Center for Mathematics and Computer Science, Amsterdam Netherlands

### **Askey Scheme for Hypergeometric Orthogonal Viewed from Asymptotic Analysis**

Temme, N. M.; Lopez, J. L.; Jan. 31, 2000; 18p

Report No.(s): PB2002-103777; MAS-R0005; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Many limits are known for hypergeometric orthogonal polynomials that occur in the Askey scheme. We show how asymptotic representations can be derived by using the generating functions of the polynomials. For example, we discuss the asymptotic representation of the Meixner-Pollaczek, Jacobi, Meixner, and Krawtchouk polynomials in terms of Laguerre polynomials.

NTIS

*Asymptotic Series; Hypergeometric Functions; Mathematical Models; Orthogonal Functions; Numerical Analysis*

**20020040858** Center for Mathematics and Computer Science, Amsterdam Netherlands

### **Accuracy and Stability of Splitting with Stabilizing Corrections**

Hundsdoerfer, W. H.; Dec. 31, 1999; 30p

Report No.(s): PB2002-103772; MAS-R9935; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

This paper contains a convergence analysis for the method of Stabilizing Corrections, which is an internally consistent splitting scheme for initial-boundary value problems. To obtain more accuracy and a better treatment of explicit terms several extensions are regarded and analyzed. The relevance of the theoretical results is tested for convection-diffusion-reaction equations.

NTIS

*Accuracy; Numerical Stability; Boundary Value Problems*

## COMPUTER OPERATIONS AND HARDWARE

*Includes hardware for computer graphics, firmware and data processing. For components see 33 Electronics and Electrical Engineering. For computer vision see 63 Cybernetics, Artificial Intelligence and Robotics.*

**20020039531** NASA Ames Research Center, Moffett Field, CA USA

**Onward to Petaflops Computing**

Bailey, David H., NASA Ames Research Center, USA; [1997]; 5p; In English

Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

With programs such as the US High Performance Computing and Communications Program (HPCCP), the attention of scientists and engineers worldwide has been focused on the potential of very high performance scientific computing, namely systems that are hundreds or thousands of times more powerful than those typically available in desktop systems at any given point in time. Extending the frontiers of computing in this manner has resulted in remarkable advances, both in computing technology itself and also in the various scientific and engineering disciplines that utilize these systems. Within the month or two, a sustained rate of 1 Tflop/s (also written 1 teraflops, or  $10(\exp 12)$  floating-point operations per second) is likely to be achieved by the 'ASCI Red' system at Sandia National Laboratory in New Mexico. With this objective in sight, it is reasonable to ask what lies ahead for high-end computing.

Derived from text

*Computation; Computer Programs; Software Engineering*

**20020039539** NASA Ames Research Center, Moffett Field, CA USA

**Scaling Properties of Algorithms in Nanotechnology**

Saini, Subhash, MRJ, Inc., USA; Bailey, David H., NASA Ames Research Center, USA; [1996]; 6p; In English; 2nd Petaflops Frontiers Workshop, 27-31 Oct. 1996, Annapolis, MD, Annapolis, MD, USA, USA

Contract(s)/Grant(s): NAS2-14303; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

At the present time, several technologies are pressing the limits of microminiature manufacturing. In semiconductor technology, for example, the Intel Pentium Pro (which is used in the Department of Energy's ASCI 'red' parallel supercomputer system) and the DEC Alpha 21164 (which is used in the CRAY T3E) both are fabricated using 0.35 micron process technology. Recently Texas Instruments (TI) announced the availability of 0.25 micron technology chips by the end of 1996 and plans to have 0.18 micron devices in production within two years. However, some significant challenges lie down the road. These include the skyrocketing cost of manufacturing plants, the 0.1 micron foreseeable limit of the photolithography process, quantum effects, data communication bandwidth limitations, heat dissipation, and others. Some related microminiature technologies include micro-electromechanical systems (MEMS), opto-electronic devices, quantum computing, biological computing, and others. All of these technologies require the fabrication of devices whose sizes are approaching the nanometer level. As such they are often collectively referred to with the name 'nanotechnology'. Clearly nanotechnology in this general sense is destined to be a very important technology of the 21st century. The ultimate dream in this arena is 'molecular nanotechnology', in other words the fabrication of devices and materials with most or all atoms and molecules in a pre-programmed position, possibly placed there by 'nano-robots'. This futuristic capability will probably not be achieved for at least two decades. However, it appears that somewhat less ambitious variations of molecular nanotechnology, such as devices and materials based on 'buckyballs' and 'nanotubes' may be realized significantly sooner, possibly within ten years or so. Even at the present time, semiconductor devices are approaching the regime where quantum chemical effects must be considered in design.

Author

*Nanotechnology; Microminiaturization; Computerized Simulation*

**20020039547** NASA Ames Research Center, Moffett Field, CA USA

**3-D Imaging In Virtual Environment: A Scientific Clinical and Teaching Tool**

Ross, Muriel D., NASA Ames Research Center, USA; [1996]; 2p; In English; Users Conference of the National Library of medicine's Visible Human Project, 7-8 Oct. 1996, Bethesda, MD, USA

Contract(s)/Grant(s): RTOP 199-97-62-15; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The advent of powerful graphics workstations and computers has led to the advancement of scientific knowledge through three-dimensional (3-D) reconstruction and imaging of biological cells and tissues. The Biocomputation Center at NASA Ames Research Center pioneered the effort to produce an entirely computerized method for reconstruction of objects from serial sections studied in a transmission electron microscope (TEM). The software developed, ROSS (Reconstruction of Serial Sections), is now being distributed to users across the USA through Space Act Agreements. The software is in widely disparate fields such as

geology, botany, biology and medicine. In the Biocomputation Center, ROSS serves as the basis for development of virtual environment technologies for scientific and medical use. This report will describe the Virtual Surgery Workstation Project that is ongoing with clinicians at Stanford University Medical Center, and the role of the Visible Human data in the project.

Derived from text

*Imaging Techniques; Three Dimensional Models; Computer Graphics; Applications Programs (Computers)*

**20020039722** NASA Ames Research Center, Moffett Field, CA USA

**Computational Nanotechnology at NASA Ames Research Center, 1996**

Globus, Al, MRJ Technology Solutions, USA; Bailey, David, NASA Ames Research Center, USA; Langhoff, Steve, NASA Ames Research Center, USA; Pohorille, Andrew, NASA Ames Research Center, USA; Levit, Creon, NASA Ames Research Center, USA; [1996]; 27p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Some forms of nanotechnology appear to have enormous potential to improve aerospace and computer systems; computational nanotechnology, the design and simulation of programmable molecular machines, is crucial to progress. NASA Ames Research Center has begun a computational nanotechnology program including in-house work, external research grants, and grants of supercomputer time. Four goals have been established: (1) Simulate a hypothetical programmable molecular machine replicating itself and building other products. (2) Develop molecular manufacturing CAD (computer aided design) software and use it to design molecular manufacturing systems and products of aerospace interest, including computer components. (3) Characterize nanotechnologically accessible materials of aerospace interest. Such materials may have excellent strength and thermal properties. (4) Collaborate with experimentalists. Current in-house activities include: (1) Development of NanoDesign, software to design and simulate a nanotechnology based on functionalized fullerenes. Early work focuses on gears. (2) A design for high density atomically precise memory. (3) Design of nanotechnology systems based on biology. (4) Characterization of diamondoid mechanosynthetic pathways. (5) Studies of the laplacian of the electronic charge density to understand molecular structure and reactivity. (6) Studies of entropic effects during self-assembly. Characterization of properties of matter for clusters up to sizes exhibiting bulk properties. In addition, the NAS (NASA Advanced Supercomputing) supercomputer division sponsored a workshop on computational molecular nanotechnology on March 4-5, 1996 held at NASA Ames Research Center. Finally, collaborations with Bill Goddard at CalTech, Ralph Merkle at Xerox Parc, Don Brenner at NCSU (North Carolina State University), Tom McKendree at Hughes, and Todd Wipke at UCSC are underway.

Author

*Nanotechnology; Software Engineering; Aerospace Systems; Computer Systems Design*

**20020040775** Fermi National Accelerator Lab., Batavia, IL USA

**Redundant arrays of IDE drives**

Sanders, D. A.; Jan. 02, 2002; 5p; In English

Report No.(s): DE2002-789841; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors report tests of redundant arrays of IDE disk drives for use in offline high energy physics data analysis. Parts costs of total systems using commodity EIDE disks are now at the \$4000 per Terabyte level. Disk storage prices have now decreased to the point where they equal the cost per Terabyte of Storage Technology tape silos. The disks, however, offer far better granularity; even small institutions can afford to deploy systems. The tests include reports on software RAID-5 systems running under Linux 2.4 using Promise Ultra 100(trademark) disk controllers. RAID-5 protects data in case of a single disk failure by providing parity bits. Tape backup is not required. Journaling file systems are used to allow rapid recovery from crashes. The data analysis strategy is to encapsulate data and CPU processing power. Analysis for a particular part of a data set takes place on the PC where the data resides. The network is only used to put results together. They explore three methods of moving data between sites; internet transfers, not pluggable IDE disks in FireWire cases, and DVD-R disks.

NTIS

*Data Processing; Redundancy; Software Engineering; Arrays; Controllers*

## COMPUTER PROGRAMMING AND SOFTWARE

*Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.*

**20020039295** Sterling Software, Inc., USA

**The Need for Vendor Source Code at NAS**

Carter, Russell, Sterling Software, Inc., USA; Acheson, Steve, Sterling Software, Inc., USA; Blaylock, Bruce, Sterling Software, Inc., USA; Brock, David, Sterling Software, Inc., USA; Cardo, Nick, Sterling Software, Inc., USA; Ciotti, Bob, Sterling Software, Inc., USA; Poston, Alan, Sterling Software, Inc., USA; Wong, Parkson, Sterling Software, Inc., USA; [1997]; 10p; In English  
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-62

Report No.(s): NAS-96-022-Rev; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Numerical Aerodynamic Simulation (NAS) Facility has a long standing practice of maintaining buildable source code for installed hardware. There are two reasons for this: NAS's designated pathfinding role, and the need to maintain a smoothly running operational capacity given the widely diversified nature of the vendor installations. NAS has a need to maintain support capabilities when vendors are not able; diagnose and remedy hardware or software problems where applicable; and to support ongoing system software development activities whether or not the relevant vendors feel support is justified. This note provides an informal history of these activities at NAS, and brings together the general principles that drive the requirement that systems integrated into the NAS environment run binaries built from source code, onsite.

Author

*Computerized Simulation; Aerodynamics; Computational Fluid Dynamics; Systems Engineering; Support Systems*

**20020039316** Department of the Navy, Washington, DC USA

**Improved Fuzzy Logic Processing System and Method with Uncertain Input**

Ganesh, Chidambar, Inventor; Aug. 17, 2001; 43p; In English

Patent Info.: Filed 17 Aug. 2001; US-Patent-Appl-SN-09932567

Report No.(s): AD-D019995; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A fuzzy inference system and method are disclosed that may be used not only with known or definite data input but also with uncertain data input. The uncertain data input may be represented by a set of values wherein the possibility of any particular or specific value within the set being the true or accurate value is uncertain. A set of rules are provided within a rule decomposer that are used to produce a plurality of mappings such as a plurality of one dimensional solutions. A union operator is utilized for determining a conjunction of the plurality of mappings such as the plurality of one dimensional solutions. The system output may then be used for control purposes such as, for example only, a combat control system to provide a tactical picture, decision assist, presets for a guidance system, or the like.

DTIC

*Fuzzy Systems; Input; Uncertain Systems; Patent Applications*

**20020039330** MRJ, Inc., Moffett Field, CA USA

**Foundations for Measuring Volume Rendering Quality**

Williams, Peter L., Vassar Coll., USA; Uselton, Samuel P., MRJ, Inc., USA; [1997]; 28p; In English

Contract(s)/Grant(s): NAS2-14303; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this paper is to provide a foundation for objectively comparing volume rendered images. The key elements of the foundation are: (1) a rigorous specification of all the parameters that need to be specified to define the conditions under which a volume rendered image is generated; (2) a methodology for difference classification, including a suite of functions or metrics to quantify and classify the difference between two volume rendered images that will support an analysis of the relative importance of particular differences. The results of this method can be used to study the changes caused by modifying particular parameter values, to compare and quantify changes between images of similar data sets rendered in the same way, and even to detect errors in the design, implementation or modification of a volume rendering system. If one has a benchmark image, for example one created by a high accuracy volume rendering system, the method can be used to evaluate the accuracy of a given image.

Author

*Classifications; Imaging Techniques; Volume*

**20020039707** NASA Ames Research Center, Moffett Field, CA USA

**A Portable MPI Implementation of the SPAI Preconditioner in ISIS++**

Barnard, Stephen T.; Clay, Robert L.; [1997]; 1p; In English; 8th SIAM Conference for Parallel Processing for Scientific Computing, 14-27 Mar. 1997, Minneapolis, MN, USA; Sponsored by Society for Industrial and Applied Mathematics, USA  
Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

A parallel MPI implementation of the Sparse Approximate Inverse (SPAI) preconditioner is described. SPAI has proven to be a highly effective preconditioner, and is inherently parallel because it computes columns (or rows) of the preconditioning matrix independently. However, there are several problems that must be addressed for an efficient MPI implementation: load balance, latency hiding, and the need for one-sided communication. The effectiveness, efficiency, and scaling behavior of our implementation will be shown for different platforms.

Author

*Matrices (Mathematics); Computer Programs; Parallel Processing (Computers)*

**20020039726** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Ethernet for Space Flight Applications**

Webb, Evan, NASA Goddard Space Flight Center, USA; [2002]; 8p; In English; Original contains color illustrations; ISBN-0-7803-7231; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

NASA's Goddard Space Flight Center (GSFC) is adapting current data networking technologies to fly on future spaceflight missions. The benefits of using commercially based networking standards and protocols have been widely discussed and are expected to include reduction in overall mission cost, shortened integration and test (I&T) schedules, increased operations flexibility, and hardware and software upgradeability/scalability with developments ongoing in the commercial world. The networking effort is a comprehensive one encompassing missions ranging from small University Explorer (UNEX) class spacecraft to large observatories such as the Next Generation Space Telescope (NGST). Mission aspects such as flight hardware and software, ground station hardware and software, operations, RF communications, and security (physical and electronic) are all being addressed to ensure a complete end-to-end system solution. One of the current networking development efforts at GSFC is the SpaceLAN (Spacecraft Local Area Network) project, development of a space-qualifiable Ethernet network. To this end we have purchased an IEEE 802.3-compatible 10/100/1000 Media Access Control (MAC) layer Intellectual Property (IP) core and are designing a network node interface (NNI) and associated network components such as a switch. These systems will ultimately allow the replacement of the typical MIL-STD-1553/1773 and custom interfaces that inhabit most spacecraft. In this paper we will describe our current Ethernet NNI development along with a novel new space qualified physical layer that will be used in place of the standard interfaces. We will outline our plans for development of space qualified network components that will allow future spacecraft to operate in significant radiation environments while using a single onboard network for reliable commanding and data transfer. There will be a brief discussion of some issues surrounding system implications of a flight Ethernet. Finally, we will show an onboard network architecture for a proposed new mission using Ethernet for science data transport.

Author

*Computer Programs; End-to-End Data Systems; Ethernet; Intellectual Property; Local Area Networks; Space Flight*

**20020039733** RECOM Technologies, Inc., Computational Sciences Div., Moffett Field, CA USA

**A Bookmarking Service for Organizing and Sharing URLs**

Keller, Richard M., RECOM Technologies, Inc., USA; Wolfe, Shawn R., RECOM Technologies, Inc., USA; Chen, James R., RECOM Technologies, Inc., USA; Mathe, Nathalie, RECOM Technologies, Inc., USA; Rabinowitz, Joshua L., Caelum Research Corp., USA; [1997]; 1p; In English; Sixth International World Wide Web Conference, 7-11 Apr. 1997, Santa Clara, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Web browser bookmarking facilities predominate as the method of choice for managing URLs. In this paper, we describe some deficiencies of current bookmarking schemes, and examine an alternative to current approaches. We present WebTagger(TM), an implemented prototype of a personal bookmarking service that provides both individuals and groups with a customizable means of organizing and accessing Web-based information resources. In addition, the service enables users to supply feedback on the utility of these resources relative to their information needs, and provides dynamically-updated ranking of resources based on incremental user feedback. Individuals may access the service from anywhere on the Internet, and require no special software. This service greatly simplifies the process of sharing URLs within groups, in comparison with manual methods involving email. The underlying bookmark organization scheme is more natural and flexible than current hierarchical schemes supported by the major Web browsers, and enables rapid access to stored bookmarks.

Author

*World Wide Web; Websites; Information Management*

**20020039912** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**An Enterprise Information System Data Architecture Guide *Final Report***

Lewis, Grace A.; Cornella-Dorda, Santiago; Place, Pat; Plakosh, Daniel; Seacord, Robert C.; Oct. 2001; 73p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399203; CMU/SEI-2001-TR-018; ESC-TR-2001-018; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Data architecture defines how data is stored, managed, and used in a system. It establishes common guidelines for data operations that make it impossible to predict, model, gauge, or control the flow of data in the system. This is even more important when system components are developed by or acquired from different contractors or vendors. This report describes a sample data architecture in terms of a collection of generic architectural patterns that both define and constrain how data is managed in a system that uses the Java(Trademark) 2 Enterprise Edition (J2EE) platform and the Open Applications Group Integration Specification (OAGIS). Each of these data architectural patterns illustrates a common data operation and how it is implemented in a system.

DTIC

*Information Systems; Data Management; Architecture (Computers)*

**20020040006** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Using Economic Considerations to Choose Among Architecture Design Alternatives *Final Report***

Asundi, Jayatirtha; Kazman, Rick; Klein, Mark; Dec. 2001; 56p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399151; CMU/SEI-2001-TR-035; ESC-TR-2001-035; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The software architecture forms an essential part of a complex software-intensive system. Architecture design decision-making involves addressing tradeoffs due to the presence of economic constraints. The problem is to develop a process that helps a designer choose amongst architectural options, during both initial design and its subsequent periods of upgrade, while being constrained to finite resources. To address this need for better decision-making, we have developed a method for performing economic modeling of software systems, centered on an analysis of their architecture. We call this method the Cost Benefit Analysis Method (CBAM). The CBAM incorporates the costs and benefits of architectural design decisions and provides an effective means of making such decisions. The CBAM provides a structured integrated assessment of the technical and economic issues and architectural decisions. The CBAM utilizes techniques in decision analysis, optimization, and statistics to help software architects characterize their uncertainty and choose a subset of changes that should be implemented from a larger set of alternatives. We also report on the application of this method to a real world case study.

DTIC

*Alternatives; Architecture (Computers); Software Engineering; Cost Analysis*

**20020040051** Georgia Inst. of Tech., Coll. of Computing, Atlanta, GA USA

**Modeling Multistrategy Learning as a Deliberative Process of Planning *Final Report, 1 Jun. 1997-31 Dec. 2001***

Ram, Ashwin; Dec. 31, 2000; 2p; In English

Contract(s)/Grant(s): F49620-97-1-0279

Report No.(s): AD-A399291; AFRL-SR-BL-TR-02-0068; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In July, we presented work related to the ARL project at two conferences. The first presentation at SCI-98 in Orlando, Florida discussed our use of visualization techniques to develop, refine, and evaluate various algorithms during the different stages of the project. The second presentation concerned our initial successes using qualitative representations to recognize patterns of movement in NTC battle data and was made at the annual conference of the American Association of Artificial Intelligence (AAAI), one of the largest AI forums. Much of the first months of the project was spent preparing the final revisions for publication.

DTIC

*Software Engineering; Artificial Intelligence; Machine Learning; Visual Observation*

**20020040066** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Capability Maturity Model Integration (CMMIsm), Version 1.1. CMMIsm for Systems Engineering and Software Engineering (CMMI-SE/SW, V1.1). Continuous Representation *Final Report***

Dec. 2001; 646p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399225; CMU/SEI-20002-TR-001; ESC-TR-2002-001; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

Capability Maturity Model Integration (CMMI(Service Mark)) models have evolved the Capability Maturity Model (CMM(registered)) concept, established by the Capability Maturity Model for Software (SW-CMM), to a new level that enables the continued growth and expansion of the CMM concept to multiple disciplines. Like the SW-CMM, EIA/IS 731, IPD-CMM, and other process improvement models, CMMI models are tools that help organizations improve their processes. This CMMI model is designed to help organizations improve their product and service development, acquisition, and maintenance processes. Concepts covered by this model include systems engineering and software engineering as well as traditional CMM concepts such as process management and project management. Each CMMI model is designed to be used in concert with other CMMI models, making it easier for organizations to pursue enterprise-wide process improvement at their own pace. This CMMI model has a continuous representation, which focuses on measuring process improvement using capability levels. Capability levels apply to process-improvement achievement within individual process areas such as configuration management or verification.

DTIC

*Computer Programming; Software Engineering; Systems Engineering*

**20020040067** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Capability Maturity Model (trade name) Integration (CMMIsm), Version 1.1. CMMIsm for Systems Engineering and Software Engineering (CMMI-SE/SW, V1.1) Staged Representation *Final Report***

Dec. 2001; 642p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399224; CMU/SEI-2002-TR-002; ESC\*-TR-2002-002; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

Capability Maturity Model Integration (CMMI(Service Mark)) models have evolved the Capability Maturity Model (CMM(registered)) concept, established by the Capability Maturity Model for Software (SW-CMM), to a new level that enables the continued growth and expansion of the CMM concept to multiple disciplines. Like the SW-CMM, EIA/IS 731, IPD-CMM, and other process improvement models, CMMI models are tools that help organizations improve their processes. This CMMI model is designed to help organizations improve their product and service development, acquisition, and maintenance processes. Concepts covered by this model include systems engineering and software engineering as well as traditional CMM concepts such as process management and project management. Each CMMI model is designed to be used in concert with other CMMI models, making it easier for organizations to pursue enterprise-wide process improvement at their own pace. This CMMI model has a staged representation, which focuses on measuring process improvement using maturity levels. Maturity levels apply to process-improvement achievement across the organizational unit using the model.

DTIC

*Software Engineering; Systems Engineering*

**20020040070** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Capability Maturity Model Integration (CMMIsm) Version 1.1. CMMIsm for Systems Engineering, Software Engineering, and Integrated Product and Process Development (CMMI-SE/SW/IPPD, V1.1). Staged Representation *Final Report***

Dec. 2001; 707p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399221; CMU/SEI-2002-TR-004; ESC-TR-2002-004; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

Capability Maturity Model Integration (CMMI(Service Mark)) models have evolved the Capability Maturity Model (CMM(registered)) concept, established by the Capability Maturity Model for Software (SW-CMM), to a new level that enables the continued growth and expansion of the CMM concept to multiple disciplines. Like the SW-CMM, EIA/IS 731, IPD-CMM, and other process improvement models, CMMI models are tools that help organizations improve their processes. This CMMI model is designed to help organizations improve their product and service development, acquisition, and maintenance processes. Concepts covered by this model include systems engineering, software engineering, and integrated product and process

development as well as traditional CMM concepts such as process management and project management. Each CMMI model is designed to be used in concert with other CMMI models, making it easier for organizations to pursue enterprise-wide process improvement at their own pace. This CMMI model has a staged representation, which focuses on measuring process improvement using maturity levels. Maturity levels apply to process-improvement achievement across the organizational unit using the model.

DTIC

*Software Engineering; Systems Engineering*

**20020040088** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Standard CMMIsm Appraisal Method for Process Improvement (SCAMPIsm), Version 1.1: Method Definition Document *Final Report***

Dec. 2001; 245p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399204; CMU/SEI-2001-HB-001; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The Standard CMMI Appraisal Method for Process Improvement (SCAMPI(Service Mark)) is designed to provide benchmark quality ratings relative to Capability Maturity Model(registered) Integration (CMMI(Service Mark)) models. It is applicable to a wide range of appraisal usage modes, including both internal process improvement and external capability determinations. SCAMP satisfies all of the Appraisal Requirements for CMMI (ARC) requirements for a Class A appraisal method and can support the conduct of ISO/IEC 15504 assessments. The SCAMPI Method Definition Document describes the requirements, activities, and practices associated with each of the processes that compose the SCAMPI method. It is intended to be one of the elements of the infrastructure within which SCAMPI Lead Appraisers conduct a SCAMPI appraisal. Precise listings of required practices, parameters, and variation limits, as well as optional practices and guidance for enacting the method, are covered. An overview of the method's context, concepts, and architecture is also provided.

DTIC

*Software Engineering; Data Processing*

**20020040091** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Appraisal Requirements for CMMIsm, Version 1.1 (ARC, V1.1) *Final Report***

Dec. 2001; 49p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399208; CMU/SEI-2001-TR-034; ESC-TR-2001-034; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Appraisal Requirements for CMMI (ARC) V1.1 defines the requirements considered essential to appraisal methods intended for use with CMMI models. In addition, a set of appraisal classes is defined, based on typical applications of appraisal methods. These classes are intended primarily for developers of appraisal methods to use with CMMI capability models in the context of the CMMI Product Suite. Additional audiences for the document include lead appraisers and other individuals who are involved in or may be interested in process appraisal or improvement. The approach employed to provide guidance to appraisal method developers is to define a class of typical applications of appraisal methods (which are based on years of experience in the process improvement community) called appraisal method classes. Requirements are then allocated to each class as appropriate based on the attributes associated with that class. Thus, a particular appraisal method may be declared to be an ARC class A, B, or C appraisal method. This designation implies the sets of ARC requirements that the method developer has addressed when designing the method.

DTIC

*Software Engineering; Software Reliability*

**20020040092** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Capability Maturity Model Integration (CMMIsm), Version 1.1. CMMIsm for Systems Engineering, Software Engineering, and Integrated Product and Process Development (CMMI-SE/SW/IPPD, V1.1). Continuous Representation *Final Report***

Dec. 2001; 702p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399219; CMU/SEI-2002-TR-003; ESC-TR-2002-003; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

Capability Maturity Model Integration (CMMI(Service Mark)) models have evolved the Capability Maturity Model (CMM(registered) concept, established by the Capability Maturity Model for Software (SW-CMM), to a new level that enables

the continued growth and expansion of the CMM concept to multiple disciplines. Like the SW-CMM, EIA/IS 731, IPD-CMM, and other process improvement models, CMMI models are tools that help organizations improve their processes. This CMMI model is designed to help organizations improve their product and service development, acquisition, and maintenance processes. Concepts covered by this model include systems engineering, software engineering, and integrated product and process development as well as traditional CMM concepts such as process management and project management. Each CMMI model is designed to be used in concert with other CMMI models, making it easier for organizations to pursue enterprise-wide process improvement at their own pace. This CMMI model has a continuous representation, which focuses on measuring process improvement using capability levels. Capability levels apply to process-improvement achievement within individual process areas such as configuration management or verification.

DTIC

*Software Engineering; Systems Engineering*

**20020040093** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Model-Based Verification: Analysis Guidelines**

Lewis, Grace A.; Comella-Dorda, Santiago; Gluch, David P.; Hudak, John; Weinstock, Charles; Dec. 2001; 44p; In English  
Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399218; CMU/SEI-2001-TN-028; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This technical note provides guidance for the analysis activity that occurs during the interpretation of results produced by model-checking tools. In the model-checking analysis activity, the main question is, 'Does the system behave correctly'? to answer this question, a model and a set of expected properties are used as input to a model checker. The expected output is a confirmation or refutation of the specified expected properties. In most cases, if the model checker does not confirm the property, it provides a counterexample. Counter-examples are executions of the model showing the sequence of steps that refutes the expected property. Sometimes the state space to be explored in order to find this counterexample is so large that it cannot be completely covered. This is the state explosion problem. Models must be tuned to reduce the state space; this is a manual and intuitive task. Interpreting the model checker's output can also be difficult. The significance of the output must be assessed; its interpretation may suggest an error in the claims or the model, or a defect in the actual system. This document presents the problems related to interpreting results. It provides strategies to overcome state explosion, analyze results, and provide feedback to the system designers and developers.

DTIC

*Computer Programming; Software Reliability*

**20020040094** Air Force Research Lab., Hanscom AFB, MA USA

**Dual Surface Electric Field Integral Equation Interim Report, Oct. 1999 - Jan. 2001**

Shore, Robert A.; Yaghjian, Arthur D.; Devaney, A. J.; Jan. 2001; 102p; In English

Report No.(s): AD-A399217; AFRL-SN-HS-TR-2001-013; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A detailed analysis and solution of the problem of scattering by a perfectly electrically conducting body of revolution using the dual surface electric field integral equation (DSEFIE) is given for the first time. Scattering calculations using the DSEFIE are free from the spurious resonances that can seriously degrade the accuracy of calculations made using the conventional electric field integral equation or magnetic field integral equation. The Galerkin form of the method of moments is used to solve the DSEFIE, and the solution is given by detailed expressions suitable for computer programming. Calculations performed with a computer program of the DSEFIE solution demonstrate the removal of spurious resonances from radar cross section patterns of spheres, spheroids, and finite cylinders obtained with the conventional electric field integral equation. Cone-sphere scattering calculations show the importance of careful placement of the dual surface when the DSEFIE is applied to scatterers with narrow tips.

DTIC

*Computer Programs; Electric Fields; Electromagnetic Scattering; Integral Equations*

**20020040098** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**CMM-Based Appraisal for Internal Process Improvement (CBA IPI) Version 1.2 Method Description Final Report**

Dunaway, Donna K.; Masters, Steve; Nov. 2001; 69p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399227; CMU/SEI-2001-TR-003; ESC-TR-2001-033; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document is a high-level overview of the CMM(registered)-Based Appraisal for Internal Process Improvement (CBA IPI) V1.2 assessment method and is an update to the CBA IPI V1.1 Method Description Dunaway 96b. It provides a brief history of SEI appraisal methods, as well as establishing appraisals in the context of the IDEALSM approach to software process improvement. CBA IPI is a diagnostic tool that supports, enables, and encourages an organization's commitment to process improvement. The method helps an organization to gain insight into its software development capability by identifying strengths and weaknesses of its current processes related to the Capability Maturity Model(registered) for Software V1.1. The method focuses on identifying software improvements that are most beneficial, given an organization's business goals and current maturity level. Brief descriptions of the method activities, roles, and responsibilities are provided. In addition, guidelines are provided for establishing resource requirements for conducting a CBA IPI. The SEI Appraiser Program is discussed, detailing the requirements for persons qualified to lead CBA IPIs.

DTIC

*Software Engineering; Systems Engineering*

**20020040101** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Model-Based Verification: Guidelines for Generating Expected Properties Final Report**

Gluch, David P.; Comella-Dorda, Santiago; Hudak, John; Lewis, Grace; Weinstock, Chick; Jan. 2002; 28p; In English  
Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399228; CMU/SEI-2002-TN-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents a basic set of guidelines to facilitate the generation of expected properties in the context of Model-Based Verification. Expected properties are natural language statements that express characteristics of the behavior of a system-characteristics that are consistent with user expectations. Through model checking, expected properties of a system, formally expressed as claims, are analyzed against the model. This analysis can detect inconsistencies between models of the system and their expected properties and identify potential system defects.

DTIC

*Program Verification (Computers); Software Engineering*

**20020040122** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Fourth DoD Product Line Practice Workshop Report Final Report**

Bergey, John; Cohen, Sholom; Fisher, Matthew; Campbell, Grady; Jones, Lawrence; Oct. 2001; 81p; In English  
Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399205; CMU/SEI-2001-TR-017; ESC-TR-2001-017; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Software Engineering Institute (SEI) held the Fourth Department of Defense (DoD) Software Product Line Practice Workshop in March 2001. The workshop was a hands-on meeting to identify industry-wide best practices in software product lines; to share DoD product line practices, experiences, and issues; to discuss ways in which the current gap between commercial best practice and DoD practice can be bridged; and to obtain feedback on the first draft of the DoD Acquisition Companion to the Framework for Software Product Line Practice written by the SEI. This report synthesizes the workshop presentations and discussions.

DTIC

*Software Engineering; Production Engineering*

**20020040327** California Univ., Dept. of Information and Computer Science, Irvine, CA USA

**Specification and Dynamic Checking of Composition Constraints in Distributed Component-Based Systems Final Report, 1 Nov. 1997-31 Oct. 2001**

VAN DER Hoek, Adriaan W.; Rosenblum, David S.; Oct. 31, 2001; 194p; In English  
Contract(s)/Grant(s): F49620-98-1-0061

Report No.(s): AD-A399502; AFRL-SR-BL-TR-02-0069; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

Component-based software engineering has been a dream for at least 30 years, beginning with Doug McIlroy's seminal presentation at the 1968 NATO conference in Garmisch. The dream is rapidly becoming a reality with the advent of component interoperability standards such as ActiveX and JavaBeans, and middleware infrastructures such as NET, DCOM, and CORBA. Both civilian and military software development efforts stand to reap enormous benefits from this technology, in terms of reduced time-to-deployment, reduced development costs, increased productivity, and increased tolerance for complexity. While existing component technologies provide the basic building blocks for a component-based style of development, they still lack the fundamental mechanisms needed to ensure that systems are composed in a manner that ensures the integrity of component

interactions. This research has been dedicated to investigating such fundamental mechanisms. In particular, the research has created mechanisms for specifying and checking component compositions in distributed component-based software systems. The research was conducted along two avenues: developing architectural foundations for developing component-based software; and exploiting and extending component standards to support constraint checking. The results of these two avenues of research are described further below. The authors first briefly discuss each of the two research avenues and the projects that have resulted from pursuing these they list the significant results achieved by each of the project. The publications that have been produced by this research are listed fully in Section 4.

DTIC

*Computer Programs; Computer Systems Programs; Deployment; Interoperability*

**20020040332** Wyle Labs., Inc., Arlington, VA USA

**PCBoom3 Sonic Boom Prediction Model - Version 1.0c Interim Report**

Plotkin, Kenneth J.; May 1996; 39p; In English

Contract(s)/Grant(s): F33615-89-C-0574; AF Proj. 3037

Report No.(s): AD-A399508; AFRL-HE-WP-TR-2001-0155; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

PCBoom3 is a PC-based program that computes single-event sonic boom footprints from any supersonic vehicle exercising any maneuver in a real atmosphere, including winds. The user specifies the aircraft, the maneuver, and the atmosphere. The primary output is the sonic boom footprint in terms of contours of equal overpressure (or other amplitude metric) on the ground, relative to the aircraft's position. PCBoom3 also generates sonic boom signatures, the pressure-time history of the boom at a particular location on the ground. Spectra of these signatures are also computed. The program is operated through a menu interface, which simplifies its use and the presentation of results. The program is designed for use by personnel who are planning specific supersonic missions where sonic boom will be an issue or who are investigating sonic boom incidents. While the program is relatively simple to operate, it provides access to analysis which requires an understanding of sonic boom phenomena. A copy of this program can be obtained by contacting AFRL/HECB at (937) 255-3605 x423 or downloading the file directly from the public website at [www.afcee.brooks.af.mil/EC/noise/noisemodels.htm](http://www.afcee.brooks.af.mil/EC/noise/noisemodels.htm).

DTIC

*Sonic Booms; Computer Programs; Supersonic Aircraft; Overpressure; Mathematical Models; Footprints*

**20020040333** Army Research Inst. for the Behavioral and Social Sciences, Fort Benning, GA USA

**Working Memory and Exploration in Training the Knowledge and Skills Required by Digital Systems Final Report, Jan. 2000 - Sep. 2001**

Dyer, Jean L.; Salter, Robin S.; Dec. 2001; 132p; In English

Contract(s)/Grant(s): DA Proj. 202-62785-A-790

Report No.(s): AD-A399507; ARI-RR-1783; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Variations in computer-based training (CBT) procedures were compared in training the skills and knowledge required of a prototype map interface for the Land Warrior system. Soldiers from four Infantry courses participated, representing the chain of command within an Infantry platoon, from platoon leader to rifleman. Soldiers were first trained on codes that uniquely identified individuals and units on the map. Then soldiers learned how to use map functions such as pan, zoom, determine range, and find individuals and units. Lessons that contained a large volume of information before soldiers could apply that information and commit it to memory resulted in low scores on both the code and map exercises. Breaking up the content into smaller chunks of information tended to be more effective. Although soldiers who learned the map on their own via an exploratory condition had the lowest map performance, exploratory learning may have potential as these soldiers spent relatively little time 'exploring'. The results demonstrate the importance of adapting to individual differences in the learning rate of soldiers. They also provide insights regarding how to design effective and efficient CBT for digital systems.

DTIC

*Digital Systems; Computer Assisted Instruction; Human-Computer Interface*

**20020040343** California Univ., Berkeley, CA USA

**Compiling Explicitly Parallel Programs Final Report, May 1995-Sep. 1999**

Yelick, Kathy; Semenzato, Luigi; Pike, Geoff; Miyamoto, Carleton; Liblit, Ben; Nov. 2001; 52p; In English

Contract(s)/Grant(s): F30602-95-C-0136; AF Proj. C278

Report No.(s): AD-A399524; AFRL-IF-RS-TR-2001-241; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the Titanium language and system for high-performance parallel scientific computing. Titanium uses Java as its base, thereby leveraging the advantages of that language and allowing the focus on parallel computing issues. The main

additions to Java are immutable classes, multi-dimensional arrays, an explicitly parallel SPMD model of computation with a global address space, and zone-based memory management. The features and design approach of Titanium are discussed, including an application: a three-dimensional adaptive mesh refinement parallel Poisson solver.

DTIC

*Parallel Processing (Computers); Computational Grids; Data Processing; Compilers*

**20020040344** SRI International Corp., Computer Science Lab., Menlo Park, CA USA

**The Common Authentication Protocol Specification Language (CAPSL) integrated Protocol Environment *Final Report, Aug. 1998-Jul. 2000***

Denker, Grit; Millen, Jonathan; Rueess, Harald; Dec. 2001; 134p; In English

Contract(s)/Grant(s): F30602-98-C-0258; AF Proj. G379

Report No.(s): AD-A399523; SRI-CSL-2000-02; AFRL-IF-RS-TR-2001-260; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

CAPSL is a Common Authentication Protocol Specification Language intended to support analysis of cryptographic protocols using formal methods. CAPSL is adapted for use by various protocol analysis tools using an intermediate language, named CAPSL Intermediate Language (CIL). This report includes a CAPSL tutorial, the syntax of CAPSL and CIL, and the abstract rewriting model underlying CIL. Algorithms are given for translating CAPSL to CIL and for CIL rule optimization. Methods are given for integration of CAPSL and CIL with analysis tools, specifically Prototype Verification System (PVS), Maude, and Athena, and for protocol analysis using PVS and Maude.

DTIC

*Cryptography; Protocol (Computers); Algorithms; Programming Languages*

**20020040345** Cornell Univ., Ithaca, NY USA

**Jaguar: Extending the Predator Database System with JAVA *Final Report, Sep. 1998-Aug. 2000***

Bonnet, Philippe; Gehrke, Johannes; Oct. 2001; 40p; In English

Contract(s)/Grant(s): F30602-98-C-0266; AF Proj. 4600

Report No.(s): AD-A399529; AFRL-IF-RS-TR-2001-198; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Jaguar project is aimed at breaking down the traditional barriers that require SQL query processing to reside on the database server. Indeed, database applications will soon be accessed by large number of clients ranging from Web applications to small-scale personal devices and they will in turn access large collections of data sources ranging from Web servers to mobile sensor devices. In such applications, a large amount of computing resources lie outside the database server: they should be utilized for performance and security reasons. The objective of the Jaguar project was to define portable query execution plans that could be executed either on the server, or on a client or on a remote data source (a web site, an active disk or a sensor device). Java was chosen as a platform for the execution of these portable execution plans. New techniques supporting the execution of portable query plans on the client-site or on the server-site are the major contributions of the Jaguar project. They have been implemented as extensions to the Cornell Predator object-relational system.

DTIC

*Data Bases; Architecture (Computers); Java (Programming Language)*

**20020040371** General Accounting Office, Washington, DC USA

**DC COURTS: Disciplined Processes Critical to Successful System Acquisition**

Feb. 2002; 27p; In English

Report No.(s): AD-A399355; GAO-02-316; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

DC Courts has not yet implemented the disciplined processes necessary to reduce the risks associated with acquiring and managing the IJIS acquisition effort to acceptable levels. A disciplined software development and acquisition process maximizes the likelihood of achieving the intended results (performance) within established resources (costs) on schedule. DC Courts officials acknowledged that they do not yet have the disciplined processes in place to reduce the risks from this effort to acceptable levels. However, they also acknowledged that disciplined processes were necessary. They further noted that even though sufficient funding to fully implement disciplined processes would not be available until the system was approved and funded, they had already begun to implement some elements of a disciplined process. For example, at the time of our review, DC Courts was sending several people to be trained and certified in project management skills. The majority of the DC Courts' requirements, developed for the draft RFP, lacked the necessary specificity to ensure that the defects in these requirements have been reduced to acceptable levels and that the system would meet its users' needs. In addition, the requirements in the draft RFP did not directly relate to industry standards and the terms 'customization' and 'modification' were not clearly defined in the draft RFP. We also noted that

the system requirements were not logically grouped. DC Courts officials are electing to use the acquisition process to identify the cost, schedule, and performance gaps associated with their effort. DC Courts officials acknowledged that this approach generally increases risk; however, they concluded that the benefit to be obtained-accelerating the Implementation of a badly needed system-justifies those risks.

DTIC

*Risk; Software Engineering; Resources Management*

**20020040381** Natural Selection, Inc., La Jolla, CA USA

**Evolving Command, Control, Communications, Computers, and Intelligence, Surveillance and Reconnaissance (C4ISR) Decisions Final Report, Apr. 2000-Apr 2001**

Porto, V. W.; Fogel, Lawrence; Jan. 2002; 55p; In English

Contract(s)/Grant(s): F30602-00-C-0048; AF Proj. 459S

Report No.(s): AD-A399402; AFRL-IF-RS-TR-2001-287; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report details the investigation, development, and prototype demonstration of evolving C4ISR capabilities of aircraft in an arbitrary environment. Natural Selection, Inc. (NSI) was tasked to show how the application of the Valuated State Space Approach and evolutionary programming (EP) could be used to produce optimal behavioral plans, and develop a set of requirements for implementing this capability within an existing (or near-future) simulation engine. As a step toward the creation of an actual prototype system, a small prototype optimal planning mechanism was created using computationally intelligent techniques. A long-term goal is to develop a generalized, extensible evolutionary software system which can efficiently and effectively encompass all desired hierarchical levels of planning for air combat entities, and can be used as a tactical decision aid or training mechanism.

DTIC

*Computer Programs; Command and Control; Reconnaissance; Surveillance; Decision Support Systems*

**20020040384** Logica Carnegie Group, Pittsburgh, PA USA

**The Development of a Computer-Aided Cognitive Systems Engineering Tool to Facilitate the Design of Advanced Decision Support Systems Final Report, Apr. 1998-Apr 2000**

Potter, Scott S.; Elm, William C.; Roth, Emilie M.; Woods, David D.; Jun. 2001; 193p; In English; Prepared in cooperation with Roth Cognitive Engineering, Brookline, MA and Ohio State Univ., Columbus, OH

Contract(s)/Grant(s): F41624-98-C-6008; AF Proj. 3005

Report No.(s): AD-A399414; AFRL-HE-WP-TR-2001-0125; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The Computer-Assisted Cognitive Systems Engineering (CACSE) toolkit provides a methodology and associated software to facilitate the use of human factors/warfighter operational performance requirements data in the design of complex man-machine systems, such as those found in military C4I applications. Specifically, CACSB provides a Cognitive Task Analysis approach and associated documentation of the design thread from operator information processing and decision-making requirements to the information visualizations needed to support these functions. Thus, CACSE will help bridge the gap between the human factors community and the software engineering community for inserting decision support systems in a wide variety of operational domains.

DTIC

*Computer Aided Design; Systems Engineering; Decision Support Systems; Cognition*

**20020040385** Military Academy, Dept. of Behavioral Sciences and Leadership, West Point, NY USA

**Situation Awareness in a Virtual Environment: Description of a Subjective Assessment Scale Final Report, Jun.-Nov. 2001**

Matthews, Michael D.; Beal, Scott A.; Pleban, Robert J.; Feb. 2002; 39p; In English

Contract(s)/Grant(s): DA Proj. 202-62785-A-790

Report No.(s): AD-A399408; ARI-RR-1786; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Mission Awareness Rating Scale (MARS), a subjective situation awareness (SA) rating scale designed to assess SA content and SA workload, was tested in a series of virtual environment exercises. Sixteen enlisted soldiers, working in teams of four soldiers each, completed four urban combat missions in a virtual night environment designed to simulate the experience of working with night vision goggles - NVG (PVS-7Bs) and aiming lights. In each scenario, a different approach for simulating this NVG environment was used. After each scenario was completed, each soldier completed the MARS instrument. This yielded estimates of the SA level and workload involved in four dimensions of SA - perception, understanding, projection, and knowing what decision to make. The results indicated that MARS significantly and robustly discriminated among the different approaches, and these SA estimates were congruent with general estimates of SA content and workload while operating at night in the real

world, and with the soldier's subjective rankings of the four simulated NVG environments. While promising, MARS must be validated against objective SA measures, both in the virtual environment and in the field environment. However, MARS seems to hold promise as a relatively unobtrusive and effective SA measure.

DTIC

*Virtual Reality; Situational Awareness; Night Vision*

**20020040386** Virginia Univ., Center for Semicustom Integrated Systems, Charlottesville, VA USA

**A Unified Environment for End-to-End System Design Final Report, 3 Sep. 1993-23 Mar. 1998**

Aylor, James H.; Klenke, Robert H.; Mar. 1998; 382p; In English

Contract(s)/Grant(s): F33615-93-C-1313; AF Proj. A268

Report No.(s): AD-A399407; AFRL-IF-WP-TR-2001-1560; No Copyright; Avail: CASI; A17, Hardcopy; A03, Microfiche

The goal of this project was to create a unified end-to-end design environment which supports the integrated performance and dependability analysis of system level models and has the capability to simulate both uninterpreted and interpreted models in a common simulation environment (mixed-level modeling). This environment provides capability for analysis through simulation or analytical approaches. The above goal was built into a tool, Advanced Design Environment Prototype Tool (ADEPT), which is functional.

DTIC

*End-to-End Data Systems; Systems Engineering; High Level Languages; Hybrid Computers*

**20020040387** California Univ., Dept. of Information and Computer Science, Irvine, CA USA

**Research in Advanced Environments Final Report, Jun. 1994-Jan. 1998**

Taylor, Richard N.; Richardson, Debra J.; Selby, Richard W.; Young, Michal; Dec. 2001; 48p; In English

Contract(s)/Grant(s): F30602-94-C-0218; AF Proj. B130

Report No.(s): AD-A399426; AFRL-IF-RS-TR-2001-254; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Active process support is being created to help human developers, including non-technical managers, coordinate their activities while integrating commercial project planning tools. Analysis and testing tools are being created to provide high assurance in software, through provision of prerun-time analysis, test case development, test result checking, and test process management tools. Powerful program analysis tools are being created which enable early detection of subtle coordination errors in concurrent systems composed of heterogeneous parts. Evolvable software architectures, first in the domain of user interface software, are being created to enable a more component-based software economy. World-Wide-Web (WWW) and hypermedia technology is being developed to foster easy information access, connections between software artifacts, and human understanding of complex systems. The UCI/Purdue team developed these technologies and validated them through interaction with the aerospace community, military organizations, the commercial software world, and the open Internet community.

DTIC

*Computer Programs; Software Engineering; Distributed Processing*

**20020040398** Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA USA

**Development of a Personal Computer-Based Enlisted Personnel Allocation System (PC-EPAS) Final Report, Aug. 1997-May 1999**

Greenston, Peter M.; Lightfoot, Mary Ann; McWhite, Peter B.; Diaz, Tirso E.; Oct. 2001; 116p; In English

Contract(s)/Grant(s): MDA903-93-D-0032; Proj-D730

Report No.(s): AD-A399441; FR-WATSD-99-26; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report summarizes the development of the PC-Based Enlisted Personnel Allocation System (EPAS) through completion of the Functional Description phase (circa 1998). EPAS is a software system designed to introduce person-job-match optimization into REQUEST, the Army's training reservation system. This report reflects the results of research conducted and sponsored by the U.S. Army Research Institute over the 1993 - 1998 period. This work established the feasibility of using sophisticated optimization procedures to improve classification efficiency, as well as the additional classification gains made possible by utilizing measures of soldier performance as assignment composites in the classification process. The production version of EPAS, designed as an enhancement to and subsystem of REQUEST, will be transparent to Army applicant and career counselor. Evaluation field-testing is scheduled for FY 2002-2003.

DTIC

*Computer Programs; Military Operations; Personnel*

**20020040406** CHI Systems, Inc., Lower Gwynedd, PA USA

**Evaluation of an Interactive Electronic NATOPS (IE-NATOPS) and Associated Graphic Interaction Concepts *Final Report, 14 Jul. 1998-31 Dec. 2001***

Deaton, John; Glenn, Floyd; Burke, C. S.; Good, Michael; Dorneich, Michael; Jan. 25, 2002; 100p; In English; Original contains color images

Contract(s)/Grant(s): N00014-98-C-0066

Report No.(s): AD-A399459; 020226.9803; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This report presents the results of a benchmark evaluation of a prototype design for an Interactive Electronic NATOPS (IE-NATOPS) to support Navy aircrews. An investigation was conducted to identify aircrew information requirements for decision making associated with monitoring of aircraft system health and management of in-flight mechanical malfunctions. It was determined in two simulator-based studies with H-46 aircrews that various types of aiding in support of mechanical (and other subsystem) health monitoring and problem diagnosis are desirable and feasible, but such information must be fully integrated into the Navy helicopter NATOPS flight manual and checklists that represent training doctrine for aircraft operations. The IE-NATOPS concept is to provide the pilot in the cockpit with a computer-based presentation of the information in hard-copy manuals, providing operating information and aircraft-specific procedures. For military and commercial aviation applications, the benefits are compelling - context sensitivity, fast and cheap 'updatibility', and the capacity for embedded intelligence and embedded intelligent training. A prototype IE-NATOPS was developed for the SH-60F helicopter. Multiple options are under consideration for implementation of IE-NATOPS in the cockpit, including via an 'electronic kneeboard' system that would interface with other aircraft information and alerting systems.

DTIC

*Decision Support Systems; Decision Making; Education; Diagnosis; Computer Graphics*

**20020040558** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Experiences in Implementing Measurement Programs *Final Report***

Goethert, Wolfhart; Hayes, Will; Nov. 2001; 51p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A399165; CMU/SEI-2001-TN-026; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Despite significant improvements in implementing measurement programs for software development in industry, data collected by Rubin Systems show that a large percentage of metrics programs fail. This technical note describes some useful lessons learned at a number of organizations that have implemented measurement programs using the Goal-Driven Software Measurement methodology. It includes a description of the methodology, a discussion of the challenges, obstacles, and their solutions, an initial set of indicators and measures, as well as some artifacts (such as templates and checklists) that we have found to enable successful implementations. The main motivation of this technical note is to provide some practical advice and guidelines for planning and implementing measurement programs.

DTIC

*Software Engineering; Metrology; Data Processing*

**20020040785** Naval Surface Warfare Center, Systems Research and Technology Dept., Dahlgren, VA USA

**A Multiple Model Filter Without Markov Switching**

Rice, T. R.; Alouani, A. T.; Mar. 1998; 21p; In English; See Also ADM201041. 1998 IRIS Proceedings (1998) on CD-ROM. Prepared in cooperation with Tennessee Technological Univ. Dept. of ECE, Cookeville, TN

Report No.(s): AD-A399478; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When tracking with multi-sensor systems, the set of sensors used may be asynchronous and there may be communications delays between sensor platforms and the fusion center. Despite these conditions, it is desirable that each sensor maintains an accurate track. It has been recognized for some time that the use of a multiple model filter is superior to the use of a single model filter for tracking maneuvering targets. However, existing multiple model tracking algorithms use Markov switching, assuming that the likelihoods of the target state switching between kinematic models are known. The objectives of this paper are twofold. First, it will present a Multiple Model (MM) tracking algorithm, called the ARMM algorithm, that does not assume a priori knowledge of the target transition probability matrix. This work attempts to relax some of the assumptions found in the most widely used MM tracking algorithm. Second, it will be shown that the ARMM algorithm can also be used as the second, and final, stage in a logical process for fusing asynchronous tracks from multiple sensors that use different kinematic models in their individual track filters.

DTIC

*Targets; Tracking (Position); Electronic Filters; Multisensor Fusion; Asynchronous Motors*

**20020040786** Lockheed Martin Corp., Advanced Technology Labs., Camden, NJ USA

**Complexity and Performance Assessment for Data Fusion Systems**

Hofmann, Martin O.; Jameson, Stephen M.; Apr. 1998; 17p; In English; Original contains color images

Report No.(s): AD-A399477; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Demonstrated, documented performance is a prerequisite before a data fusion system may be deployed. Developers and users must be confident about fusion system performance across the full range of operating conditions and scenarios the system is anticipated to encounter. We report on an approach to multi-sensor data fusion performance characterization which systematically explores system performance and quantifies performance degradation at and beyond the limits of the intended application scenarios. A quantitative characterization of the complexity of test scenarios supports our experimental approach to performance assessment. Scenario complexity characterization directs creation and systematic variation of test scenarios and facilitates efficient exploration of the range of relevant fusion scenarios. Data Fusion performance metrics measure the quality of the track picture produced by the data fusion solution and the correctness of the intermediate constituent processing steps. Track picture quality is measured by the accuracy, precision, consistency, and completeness of the fused track picture. Constituent metrics function as built-in-test procedures for critical processing steps and reveal causes for sub-optimal performance. They indicate when the fusion system under test operates on a scenario which approaches the limits of its capabilities. We successfully applied the complexity and performance measures described in this paper to the development and validation of the Rotorcraft Pilot's Associate (RPA) Level 1 Sensor Fusion component.

DTIC

*Signal Processing; Data Processing; Multisensor Fusion; Multisensor Applications; Inertial Fusion (Reactor)*

**20020040792** Corps of Engineers, Engineer Research and Development Center, Vicksburg, MS USA

**Development of Simulators for In Situ Remediation Evaluation, Design, and Operation *Final Report***

Dortch, Mark S.; McGrath, Christian J.; Nitao, John J.; Widdowson, Mark A.; Yabusaki, Steve; Sep. 2001; 91p; In English; Original contains color images

Report No.(s): AD-A399606; ERDC/EL-TR-01-33; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Four simulators for modeling in situ, subsurface remediation were advanced and incorporated into the Groundwater Modeling System (GMS) during SERDP Project Cu-1062. The four simulators are MT3DMS/SEAM3D, UTCHEM, NUFT, and OS3D. The addition of these four simulators to the GMS provides a significant advancement in the present status of subsurface modeling for remediation alternatives evaluation and design. Each of these four simulators has unique capabilities for simulating innovative in situ treatment technologies, including intrinsic and engineered bioremediation, surfactant and cosolvent flushing to remove oil phase contaminants, venting technologies (e.g., soil vapor extraction, air sparging, and bioventing), and in situ chemical treatment (e.g., Fe deg permeable treatment walls). Each of the simulators was modified/improved, documented, validated against field-scale studies, and incorporated into the GMS. The GMS models will provide an invaluable tool for improving subsurface, in situ remediation selection, design, and operation, thus potentially providing significant reductions in site cleanup costs. This report provides an overview of results of the CU-1062 project and recommendations for future enhancements to the simulators.

DTIC

*Computerized Simulation; Water Treatment; Ground Water; Hydrology Models*

**20020040804** Aberdeen Proving Ground, Center for Sensing Technology, MD USA

**An Innovative Method for Presentation of Target Imagery to Human Observers in a Simulated Operational Environment**

Walrath, Rebekah A.; Nguyen, Hien T.; Rogers, Glenn A.; Nov. 1998; 10p; In English

Report No.(s): AD-A399583; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Presenting observers with single frames of electronically gathered images of a scene denies the natural variability of signal and noise as they change across time. We discuss a methodology that preserves the temporal fluctuations of signal and noise: thus faithfully representing the images produced by fielded hardware for use as laboratory perception study stimuli. Camouflaged military targets imaged by a 1st Generation Forward Looking Infrared (FLIR) system, were presented to observers in a simulated operational environment. Analog FLIR imagery from a Tube-launched Optically tracked Wire-guided (TOW) sight was digitized and looped to create a dynamic presentation. A test bed was designed to present the images and collect human performance data on a single desktop computer. The performance measures were time to detection/identification and indication of the Visible Center of Mass of the targets. These data were scored using the Hit and Kill criteria from the appropriate military field manuals.

DTIC

*FLIR Detectors; Computerized Simulation; Infrared Imagery; Infrared Instruments; Optical Tracking; Targets*

**20020040853** Syracuse Univ., NY USA

**Investigation of Software Environment for Configurable Aerospace Command and Control (CACC) Systems *Final Report***

Chen, C. Roger, Syracuse Univ., USA; Jan. 2002; 71p; In English

Contract(s)/Grant(s): F30602-99-2-0508; AF Proj. 558S

Report No.(s): AD-A399517; AFRL-IF-RS-TR-2001-289; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

To overcome large scale system design problems conventional approaches that consist of: (1) system functionality definition, (2) partitioning of the system functionality into sub-functional blocks, (3) independent development of each sub-functional block into a sub-system component, and (4) connection of sub-system components to form an entire system, one has to address the foundation of a Configurable Aerospace Command Center (CACC) system, such that it will provide the capability of allowing sub-systems and components to be pluggable into the environment and form a coherent system, where exchanges of events, data and functions across the boundaries of sub-systems will be seamless and actions on all sub-systems will be globally coordinated and optimally controlled. In this report, we investigate many such issues and look into existing systems, and perform feasibility assessment on existing collaboration systems to see how much intersystem collaboration functions can possibly be developed through an external functional extension, i.e., without the access or modification of the source code of existing collaboration systems.

DTIC

*Command and Control; Design Analysis; Systems Engineering; Software Engineering; Configuration Management*

**20020040860** WetStone Technologies, Inc., Cortland, NY USA

**Formal Methods Framework *Final Report, Jun. 1999 - Jun. 2000***

Feb. 2002; 103p; In English

Contract(s)/Grant(s): F30602-99-C-0166; AF Proj. 1065

Report No.(s): AD-A399514; AFRL-IF-RS-TR-2002-6; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This contract final technical report documents the Formal Methods Framework (FMF) project results. This project consider the impact of formal methods on industries such as high assurance and telecommunications software and proposes a framework within which formal method can be used more effectively to produce reliable and correct software. A FMF is developed an populated, and areas of future improvement such as extensibility, scalability and range of applications are identified.

DTIC

*Formalism; Telecommunication*

**20020040861** Crystaliz, Inc., Concord, MA USA

**Environment for Reflective Agents (ERA) *Final Report, Jul. 1998 - Sep. 2001***

Virdhagriswaran, Sankar, Crystaliz, Inc., USA; Jan. 2002; 49p; In English

Contract(s)/Grant(s): F30602-98-C-0250; AF Proj. AGEN

Report No.(s): AD-A399513; AFRL-IF-RS-TR-2001-293; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Environment for Reflective Agents (ERA) is an asynchronous, distributed computing environment that supports the interactive design and development of distributed network applications. Using ERA's VERA editor, "casual" programmers can dynamically configure the workflow between autonomous agents, specifying which agents talk to which, and how. ERA also permits networks that are recursively constructed from existing agents and networks, in a bottom-up manner. ERA allows both direct and scripted control of intrinsically distributed, heterogeneous organizations. The activities of multiple agents are coordinated by using scripts to direct the transfer of information between them. ERA expects most substantive processing to be done by conventional agents, either people, application programs, or conventional scripts. The tools provided by ERA focus mainly on the question of who talks to whom and how. The report begins with the concepts, philosophy, and goals of ERA, then presents the initial Scheme-based ERA prototype and ERA server, which is capable of interpreting the scripting languages ERASE and DERAILED. Finally, the Java-Based ERA server is presented, together with a description of how the user can compare hierarchical, distributed agent networks interactively using the visual editor.

DTIC

*Computer Systems Programs; Information Transfer; Computer Networks*

**20020040890** University of Southern California, Information Sciences Inst., Marina del Rey, CA USA

**A Portable System for Integrating Inconsistent and Partial Information Sources (SIMSPORT) Final Report**

Arens, Yigal, University of Southern California, USA; Jan. 2002; 88p; In English

Contract(s)/Grant(s): F30602-97-2-0352; AF Proj. IIST

Report No.(s): AD-A399516; AFRL-IF-RS-TR-2001-274; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The objective of this effort was to provide support for the integration, enhancement, transition, and evaluation of component technologies produced from the Defense Advanced Research Projects Agency's (DARPA) Intelligent Integration of Information (I<sup>3</sup>), Intelligent Collaboration and Visualization (IC&V), and Information Management (IM) programs. This effort investigated and developed techniques to extend the capabilities of SIMS to integrate data that is incorrect, inconsistent, and/or missing. The SIMS approach was extended to deal with HTML documents accessible through the HTTP protocol. Data mining techniques were used to create automated and semi-automated modeling facilities. A facility for searching for patterns present in data and in the database structure of new sources was created. Overall, this effort has made the integration of multiple, distributed, inconsistent information sources a practical reality and easily portable at reasonable cost.

DTIC

*Data Mining; Information Management; Information Systems; Software Engineering*

**62**

**COMPUTER SYSTEMS**

*Includes computer networks and distributed processing systems. For information systems see 82 Documentation and Information Science. For computer systems applied to specific applications, see the associated category.*

**20020039143** NASA Ames Research Center, Moffett Field, CA USA

**Parallel Processing of Adaptive Meshes with Load Balancing**

Das, Sajal K., Texas Univ., USA; Harvey, Daniel J., Texas Univ., USA; Biswas, Rupak, NASA Ames Research Center, USA; [2001]; 8p; In English

Contract(s)/Grant(s): NCC2-5395; TARP-97-003594-013; RTOP 725-10-31; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Many scientific applications involve grids that lack a uniform underlying structure. These applications are often also dynamic in nature in that the grid structure significantly changes between successive phases of execution. In parallel computing environments, mesh adaptation of unstructured grids through selective refinement/coarsening has proven to be an effective approach. However, achieving load balance while minimizing interprocessor communication and redistribution costs is a difficult problem. Traditional dynamic load balancers are mostly inadequate because they lack a global view of system loads across processors. In this paper, we propose a novel and general-purpose load balancer that utilizes symmetric broadcast networks (SBN) as the underlying communication topology, and compare its performance with a successful global load balancing environment, called PLUM, specifically created to handle adaptive unstructured applications. Our experimental results on an IBM SP2 demonstrate that the SBN-based load balancer achieves lower redistribution costs than that under PLUM by overlapping processing and data migration.

Author

*Parallel Processing (Computers); Unstructured Grids (Mathematics); Dynamic Loads; Balancing*

**20020039331** NASA Ames Research Center, Moffett Field, CA USA

**Towards Scalable 1024 Processor Shared Memory Systems**

Ciotti, Robert B., NASA Ames Research Center, USA; [2001]; 5p; In English; Cray User Group Conference, May 2001, Palm Springs, CA, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Over the past 3 years, NASA Ames has been involved in a cooperative effort with SGI to develop the largest single system image systems available. Currently a 1024 Origin3000 is under development, with first boot expected later in the summer of 2001. This paper discusses some early results with a 512p Origin3000 system and some arcane IRIX system calls that can dramatically improve scaling performance.

Author

*Memory (Computers); Computer Programs; Software Development Tools; Imaging Techniques; Central Processing Units*

**20020039711** NASA Ames Research Center, Moffett Field, CA USA

**NAS Parallel Benchmark Results 11-96, 1.0**

Bailey, David H., MRJ, Inc., USA; Bailey, David, NASA Ames Research Center, USA; [1997]; 56p; In English  
Contract(s)/Grant(s): NAS2-14303

Report No.(s): NAS-96-18; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The NAS Parallel Benchmarks have been developed at NASA Ames Research Center to study the performance of parallel supercomputers. The eight benchmark problems are specified in a "pencil and paper" fashion. In other words, the complete details of the problem to be solved are given in a technical document, and except for a few restrictions, benchmarkers are free to select the language constructs and implementation techniques best suited for a particular system. These results represent the best results that have been reported to us by the vendors for the specific 3 systems listed. In this report, we present new NPB (Version 1.0) performance results for the following systems: DEC Alpha Server 8400 5/440, Fujitsu VPP Series (VX, VPP300, and VPP700), HP/Convex Exemplar SPP2000, IBM RS/6000 SP P2SC node (120 MHz), NEC SX-4/32, SGI/CRAY T3E, SGI Origin200, and SGI Origin2000. We also report High Performance FORTRAN (HPF) based NPB results for IBM SP2 Wide Nodes, HP/Convex Exemplar SPP2000, and SGI/CRAY T3D. These results have been submitted by Applied Parallel Research (APR) and Portland Group Inc. (PGI). We also present sustained performance per dollar for Class B LU, SP and BT benchmarks.

Author

*Supercomputers; Computerized Simulation; Computer Systems Performance; Parallel Processing (Computers)*

**20020039859** NASA Ames Research Center, Moffett Field, CA USA

**Fast 3D Net Expeditions: Tools for Effective Scientific Collaboration on the World Wide Web**

Watson, Val, NASA Ames Research Center, USA; [1996]; 1p; In English; 1st International Symposium on Digital Future, 21-23 Jan. 1997, Madrid, Spain; No Copyright; Avail: Issuing Activity; Abstract Only

Two new technologies, the FASTexpedition and Remote FAST, have been developed that provide remote, 3D (three dimensional), high resolution, dynamic, interactive viewing of scientific data. The FASTexpedition permits one to access scientific data from the World Wide Web, take guided expeditions through the data, and continue with self controlled expeditions through the data. Remote FAST permits collaborators at remote sites to simultaneously view an analysis of scientific data being controlled by one of the collaborators. Control can be transferred between sites. These technologies are now being used for remote collaboration in joint university, industry, and NASA projects. Also, NASA Ames Research Center has initiated a project to make scientific data and guided expeditions through the data available as FASTexpeditions on the World Wide Web for educational purposes. Previously, remote visualization of dynamic data was done using video format (transmitting pixel information) such as video conferencing or MPEG (Motion Picture Expert Group) movies on the Internet. The concept for this new technology is to send the raw data (e.g., grids, vectors, and scalars) along with viewing scripts over the Internet and have the pixels generated by a visualization tool running on the viewers local workstation. The visualization tool that is currently used is FAST (Flow Analysis Software Toolkit). The advantages of this new technology over using video format are: (1) The visual is much higher in resolution (1280x1024 pixels with 24 bits of color) than typical video format transmitted over the network. (2) The form of the visualization can be controlled interactively (because the viewer is interactively controlling the visualization tool running on his workstation). (3) A rich variety of guided expeditions through the data can be included easily. (4) A capability is provided for other sites to see a visual analysis of one site as the analysis is interactively performed. Control of the analysis can be passed from site to site. (5) The scenes can be viewed in 3D using stereo vision. (6) The network bandwidth for the visualization using this new technology is much smaller than when using video format. (The measured peak bandwidth used was 1 Kbit/sec whereas the measured bandwidth for a small video picture was 500 Kbits/sec.) This talk will illustrate the use of these new technologies and present a proposal for using these technologies to improve science education.

Author

*World Wide Web; Scientific Visualization; Interactive Control; Education*

**20020040052** New Mexico State Univ., Dept. of Electrical and Computer Engineering, Las Cruces, NM USA

**Data Compression Techniques to Reduce Bandwidth Final Report, 1 Dec. 1997-31 Dec 1999**

Horan, Shield; Aug. 2000; 161p; In English

Contract(s)/Grant(s): F49620-98-1-0102

Report No.(s): AD-A399290; AFRL-SR-BL-TR-02-0071; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Bandwidth is a precious commodity. In order to make the best use of what is available, better modulation schemes need to be developed, or less data needs to be sent. This paper will investigate the option of sending less data via data compression. The structure and the entropy of the data determine how much lossless compression can be obtained for a given set of data. This paper

shows the data structure and entropy for several actual telemetry data sets and the resulting lossless compression obtainable using data compression techniques.

DTIC

*Data Compression; Bandwidth; Data Structures*

**20020040106** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Can We Ever Build Survivable Systems from COTS Components? Final Report**

Lipson, Howard F.; Mead, Nancy R.; Moore, Andrew P.; Dec. 2001; 33p; In English

Contract(s)/Grant(s): F189628-00-C-0003

Report No.(s): AD-A399238; CMU/SEI-2001-TN-030; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Using commercial off-the-shelf (COTS) components to build large, complex systems has become the standard way that systems are designed and implemented by government and industry. Much of the literature on COTS-based systems concedes that such systems are not suitable for mission-critical applications. However, there is considerable evidence that COTS-based systems are being used in domains where significant economic damage and even loss of life are possible in the event of a major system failure or compromise. Can we ever build such systems so that the risks are commensurate with those typically taken in other areas of life and commerce? This paper describes a risk-mitigation framework for deciding when and how COTS components can be used to build survivable systems. Successful application of the framework requires working with vendors to reduce the risks associated with using the vendors' products, and improving and making the best use of your own organization's risk-management skills.

DTIC

*Commercial Off-The-Shelf Products; Computer Networks; Computer Information Security*

**20020040379** Army Research Inst. for the Behavioral and Social Sciences, Fort Benning, GA USA

**The Computer Background of Soldiers in Infantry Courses: FY01 Final Report, Oct. 2000-Jun. 2001**

Singh, Harnam; Dyer, Jean L.; Dec. 2001; 53p; In English

Contract(s)/Grant(s): Proj-A790

Report No.(s): AD-A399394; ARI-RR-1784; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The research examined soldiers' experiences with computers, self-perceptions of their computer skill, and their ability to identify frequently-used, Windows-based icons. The report documents the results of the third and last year of Infantry School course surveys. The soldiers surveyed represented the personnel structure of an Infantry rifle platoon. Computer ownership was high among all soldiers. Computer experience was gained in different ways, reflecting the circumstances where computers were available to and used by the groups surveyed. Lieutenants and senior noncommissioned officers had the most computer expertise as shown by their icon scores. However, the lieutenants had a higher perception of their computer skill. For junior noncommissioned officers and privates, the picture was more diverse. A substantial portion of these two groups had limited computer skills, as reflected in their icon scores and self-ratings. The results indicate that prior and special training on basic computer skills would be required for many of these younger soldiers before starting specialized training on a computer-based tactical system. Although only Infantrymen were surveyed, the results should apply to other soldiers throughout the Army with similar educational and military experience.

DTIC

*Military Operations; Personnel; Computers*

**20020040380** Army Research Inst. for the Behavioral and Social Sciences, Fort Benning, GA USA

**Computer Backgrounds of Soldiers in Army Units: FY00 Final Report, Mar.-Dec. 2000**

Fober, Gene W.; Bredthauer, Jennifer L.; Dyer, Jean; Oct. 2001; 72p; In English; Prepared in collaboration with Auburn University

Contract(s)/Grant(s): Proj-A790

Report No.(s): AD-A399393; ARI-RR-1778; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The ability of soldiers to exploit systems using computers and to learn software quickly depends in part on their prior experience. Soldiers from four Army installations were given a survey that examined their experiences with computers, self-perceptions of their skill, and an objective test of their ability to identify Windows-based icons. The officers and senior non-commissioned officers (NCOs) had the most computer expertise as measured by both subjective and objective measures. For enlisted and junior NCOs the picture was more diverse; almost half the soldiers had limited skills. Owning a computer, frequency of using a computer, and using a computer at work related highly with computer expertise. When specialists (rank of E4) were examined separately, opportunity to use computers as part of their job was related to computer expertise. The results indicate a

diverse population, including soldiers with limited computer skills as well as those with programming skills. Those individuals with limited skills would benefit from basic computer training prior to learning to operating one of the Army's digital systems.

DTIC

*Military Operations; Computers; Personnel*

**20020040408** Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA USA

**Question Generation as a Learning Multiplier in Distributed Learning Environments *Interim Report***

Graesser, Arthur C.; Wisher, Robert A.; Oct. 2001; 43p; In English

Report No.(s): AD-A399456; ARI-TR-1121; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report provides a rationale for question generation as a workable learning multiplier in distributed learning environments. The rationale was derived from a thorough review of recent research on questioning from multiple perspectives: psychology, cognitive science, computational linguistics, and information systems design. Based on this review, nine practices were identified for immediate use in both the conventional classroom and distributed learning settings. If employed properly, question generation strategies in distributed learning can increase a soldier's depth of understanding about the workings of a complex system. The strategy is particularly useful for asynchronous distance learning, where the instructor is not necessarily available to answer questions promptly.

DTIC

*Education; Cognition; Complex Systems; Information Systems; Systems Engineering*

**20020040805** Booz-Allen and Hamilton, Inc., McLean, VA USA

**Cyberwar as Anti-War: The Keystroke is Mightier than the Sword**

Mays, John B.; Nov. 02, 1998; 8p; In English

Report No.(s): AD-A399582; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report relates examples of wars in the past as wars to that utilize the power of information. Cyberwar is another powerful type of war that can be described as "actions taken during times of crisis or conflict (including war) to affect adversary information and information systems while defending one's own information and information systems." Computer network attack is a derivative of the commercial sector.

DTIC

*Computer Networks; Electronic Warfare; Information Systems*

**20020040870** BBNT Solutions, LLC, Columbia, MD USA

**Market-Based Service Quality Differentiation (MBSQD) (Formerly Cartography of Cyberspace) *Final Report, Apr. 2000-Jul. 2001***

Frenz, Mike; Mankins, David; Krishnan, Rajesh; Zao, John; Selfridge, Oliver; Jan. 2002; 78p; In English

Contract(s)/Grant(s): F30602-00-C-0088; AF Proj. IAST

Report No.(s): AD-A399587; AFRL-IF-RS-TR-2001-278; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This effort was initially part of the DARPA Information Assurance Science and Engineering Tools (IASSET) program and then changed to part of the Survivable Wired & Wireless Infrastructure for Military operations (SWWIM) program. The objective was to develop baseline taxonomy on which to build a foundation for the development of a formal science of cyberscience, survey related scientific areas to extract specific relevant concepts which would contribute to the formalization of cyberspace, extend these identified models in the IA domain and validate their usefulness in the context of information assurance. BBN focused on the Economic task of this effort. In particular, they looked at market-based approaches to network quality of service. They designed an architecture to counter the asymmetric threat posed in typical computer attacks by incorporating mechanisms into the network interactions. The particular attack that they focused was a DDoS attack. They were able to generate baseline experimental results from this model that demonstrated the desirability of developing a real-time infrastructure based market-based ideas.

DTIC

*Military Operations; Information; Economics; Data Transmission*

## CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

*Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also 54 Man/System Technology and Life Support.*

**20020039159** NASA Ames Research Center, Moffett Field, CA USA

**Multiagent Modeling and Simulation in Human-Robot Mission Operations Work System Design**

Sierhuis, Maarten, Research Inst. for Advanced Computer Science, USA; Clancey, William J., University of West Florida, USA; Sims, Michael H., NASA Ames Research Center, USA; [2001]; 10p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes a collaborative multiagent modeling and simulation approach for designing work systems. The Brahms environment is used to model mission operations for a semi-autonomous robot mission to the Moon at the work practice level. It shows the impact of human-decision making on the activities and energy consumption of a robot. A collaborative work systems design methodology is described that allows informal models, created with users and stakeholders, to be used as input to the development of formal computational models.

Author

*Robots; Systems Engineering; Mission Planning; Decision Making; Autonomy*

**20020039172** Research Inst. for Advanced Computer Science, Moffett Field, CA USA

**Verification and Validation of Model-Based Autonomous Systems**

Pecheur, Charles, Research Inst. for Advanced Computer Science, USA; [2001]; 13p; In English; 1st Annual NASA Office of Safety and Mission Assurance Software Assurance Symposium, 5-7 Sep. 2001, Morgantown, WV, USA; Sponsored by NASA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a three year project (FY99 to FY01) on the verification and validation of model based autonomous systems. The topics include: 1) Project Profile; 2) Model-Based Autonomy; 3) The Livingstone MIR; 4) MPL2SMV; 5) Livingstone to SMV Translation; 6) Symbolic Model Checking; 7) From Livingstone Models to SMV Models; 8) Application In-Situ Propellant Production; 9) Closed-Loop Verification Principle; 10) Livingstone PathFinder (LPF); 11) Publications and Presentations; and 12) Future Directions. This paper is presented in viewgraph form.

CASI

*Autonomy; Program Verification (Computers); Systems Engineering; Models*

**20020039718** Ljubljana Univ., Faculty of Electrical Engineering, Ljubljana, Slovenia

**Robust and Efficient Vision System for Mobile Robots Control: Application to Soccer Robots Zanesljiv in Ucinkovit Racunalniski Vid za Vodenje Mobilnih Robotov in Njegova Aplikacija v Robotskem Nogometu**

Klancar, Gregor, Ljubljana Univ., Slovenia; Orqueda, Omar, Consejo Nacional de Investigaciones Cientificas y Tecnicas, Argentina; Matko, Drago, Ljubljana Univ., Slovenia; Karba, Rihard, Ljubljana Univ., Slovenia; Electrotechnical Review; 2001; ISSN 0013-5852; Volume 68, No. 5, pp. 306-312; In English

Contract(s)/Grant(s): ES/A99-HX1/01; Copyright; Avail: Issuing Activity

In the paper a global vision scheme for estimation of positions and orientations of robots is presented. It can be divided into two steps. In the first, the incoming image is scanned and pixels are classified into a finite number of classes. At the same time, a segmentation algorithm is used to find corresponding regions belonging to one of the classes. In the second step, all the regions are examined. Selection of the ones, that are a part of the observed object is made by means of simple logic procedures. The novelty is focused on optimization of the processing time needed to finish the estimation of possible object positions. Also, an application of this algorithm to robot control is presented. Reference trajectories are generated by the fourth order Bezier curves and a nonholonomic trajectory follower controller is used to assure the robots to follow the prescribed curves.

Author

*Computer Vision; Robot Control; Robustness (Mathematics); Computer Programming; Mathematical Models*

**20020039738** NASA Ames Research Center, Moffett Field, CA USA

**Computational Approaches to Interface Design**

Corker, NASA Ames Research Center, USA; [1997]; 1p; In English; IUI 1997, 8 Jan. 1997, Orlando, FL, USA

Contract(s)/Grant(s): RTOP 538-04-12; No Copyright; Avail: Issuing Activity; Abstract Only

Tools which make use of computational processes - mathematical, algorithmic and/or knowledge-based - to perform portions of the design, evaluation and/or construction of interfaces have become increasingly available and powerful. Nevertheless, there

is little agreement as to the appropriate role for a computational tool to play in the interface design process. Current tools fall into broad classes depending on which portions, and how much, of the design process they automate. The purpose of this panel is to review and generalize about computational approaches developed to date, discuss the tasks which for which they are suited, and suggest methods to enhance their utility and acceptance. Panel participants represent a wide diversity of application domains and methodologies. This should provide for lively discussion about implementation approaches, accuracy of design decisions, acceptability of representational tradeoffs and the optimal role for a computational tool to play in the interface design process.

Author

*Human Performance; Human-Computer Interface; Graphical User Interface; Systems Engineering*

**20020039791** NASA Ames Research Center, Moffett Field, CA USA

**A Runtime Performance Predictor for Selecting Tabu Tenures**

Allen, John A., NASA Ames Research Center, USA; Minton, Steven N., University of Southern California, USA; [1997]; 1p; In English; Fifteenth International Joint Conference on Artificial Intelligence, 23-29 Aug. 1997, Nagaya, Japan; No Copyright; Avail: Issuing Activity; Abstract Only

One of the drawbacks of parameter based systems, such as tabu search, is the difficulty of finding the correct parameter for a particular problem. Often, rule-of-thumb advice is given which may have little or no applicability to the domain or problem instance at hand. This paper describes the application of a general technique, Runtime Performance Predictors (RPP) which can be used to determine, in an efficient manner, the correct tabu tenure for a particular problem instance. The details of the approach and a demonstration using a variant of GSAT are presented.

Author

*Predictions; Prediction Analysis Techniques; Domains; Performance Tests; Independent Variables; Run Time (Computers)*

**20020039969** NASA Ames Research Center, Moffett Field, CA USA

**Fast Context Switching in Real-Time Propositional Reasoning**

Nayak, P. Pandurang, NASA Ames Research Center, USA; Williams, Brian C., NASA Ames Research Center, USA; [1997]; 1p; In English; AIAA 1997: The Fourteenth National Conference on Artificial Intelligence, 27-31 Jul. 1997, Providence, RI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The trend to increasingly capable and affordable control processors has generated an explosion of embedded real-time gadgets that serve almost every function imaginable. The daunting task of programming these gadgets is greatly alleviated with real-time deductive engines that perform all execution and monitoring functions from a single core model, Fast response times are achieved using an incremental propositional deductive database (an LTMS). Ideally the cost of an LTMS's incremental update should be linear in the number of labels that change between successive contexts. Unfortunately an LTMS can expend a significant percentage of its time working on labels that remain constant between contexts. This is caused by the LTMS's conservative approach: a context switch first removes all consequences of deleted clauses, whether or not those consequences hold in the new context. This paper presents a more aggressive incremental TMS, called the ITMS, that avoids processing a significant number of these consequences that are unchanged. Our empirical evaluation for spacecraft control shows that the overhead of processing unchanged consequences can be reduced by a factor of seven.

Author

*Data Bases; Real Time Operation; Spacecraft Control; Switching*

**20020040323** Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA

**Cognitive Systems Engineering for Battlespace Dominance**

Kuperman, Gilbert G.; Jan. 01, 1998; 14p; In English; Original contains color images  
Report No.(s): AD-A399494; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Battlespace Dominance, across the entire conflict spectrum, is a primary objective of Joint Vision 2010, the roadmap for the USA military into the twenty-first century. Within the Air Force, Global Engagement (Fogelman & Widnall, 1996) serves to explicate the Joint Vision as it impacts the air and space forces. One of the six core competencies of the Air Force (along with Rapid Global Mobility, Precision Engagement, Global Attack, Air and Space Superiority, and Agile Combat Support) is Information Superiority over the future battlespace. They observe that the strategic perspective and the flexibility gained from operating in the airspace continuum make airmen uniquely suited for information operations. Information Superiority, from one perspective, is centered on affecting the Observe-Orient-Decide-Act (or OODA) loop (Boyd, 1987) of the decision making process.

DTIC

*Systems Engineering; Cognition; Support Systems; Airspace; Multisensor Fusion*

**20020040324** Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

**A New Framework for Multi-Sensor Image Fusion**

Singh, Ram Nandan P.; Jan. 01, 1998; 15p; In English

Report No.(s): AD-A399493; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The power of digital technology for manipulating images provides a unique, powerful tool to accomplish digital image fusion. It can facilitate fusing diverse images received from dissimilar image sensors into a composite(synthetic) image. As a result the emergence of digital image fusion technology for decomposing, comparing, mixing, and recomposing images in real time promises high potentials for applications to missile based defense systems, and finally to a digitized battlefield.

DTIC

*Multisensor Applications; Missile Defense; Multisensor Fusion*

**20020040328** Temple Univ., Philadelphia, PA USA

**Co-Channel Speech and Speaker Identification Study Final Report**

Yantorno, Robert E.; Sep. 1998; 22p; In English; Original contains color images

Report No.(s): AD-A399500; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study was comprised of two parts. The first was to determine the effectiveness of speaker identification under two different speaker identification degradation conditions, additive noise and speaker interference, using the LPC cepstral coefficient approach. The second part was to develop a method for determination of co-channel speech, i.e., speaker count, and to develop an effective method of either speech extraction or speech suppression to enhance the operation of speaker identification under co-channel conditions. The results of the first part of study indicate that under conditions of the same amount of either noise or corrupting speech, for example 0 dB SNR or TIR (target-to-interference ratio), noise is much more detrimental than corrupting speech to the operation of the speaker identification. For example, with 100% of 0 dB corrupting speech there still occurs a certain number of correct speaker identifications, i.e., about 40% accuracy. Ten (10) dB TIR interfering speech, as well as small amounts of interfering speech, i. e., 40% 0 dB TIR are not as detrimental to speaker identification. The results of the second part of the study indicate that a system for speaker count and speaker separation is possible. The harmonic sampling approach, developed during the study, uses the periodic structure of the fine structure of the frequency characteristics of voiced speech. Successful reconstruction of a single speaker indicates the potential of this approach as a candidate for speech separation. Also, it was shown that detection of co-channel speech is possible using the harmonic sampling approach. Further improvements as well as other possible approaches to the co-channel speech problem are discussed.

DTIC

*Speech Recognition; Frequency Distribution; Cepstral Analysis*

**20020040410** Space and Naval Warfare Systems Command, San Diego, CA USA

**Visioning-Applications to Human Issues in Data Fusion**

White, Franklin E., Jr; Apr. 02, 1998; 18p; In English

Report No.(s): AD-A399495; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Data Fusion: Transforms Data into Information and Knowledge.

DTIC

*Decision Making; Transformations (Mathematics); Multisensor Fusion*

**20020040803** iRobot Corp., Somerville, MA USA

**Real Time Dynamic Languages Final Report, Aug. 1996-Dec. 2000**

Pook, Polly; Aspinall, John; Pratt, Gill; Brooks, Rodney; Arsenio, Arturo; Nov. 2001; 49p; In English

Contract(s)/Grant(s): F30602-96-C-0280; AF Proj. D900

Report No.(s): AD-A399584; AFRL-IF-RS-TR-2001-242; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A behavioral programming approach to adaptive autonomous control had been completed. An advanced hexapedal crab-like robot, Ariel, was built in order to investigate methods of robotic self-adaption. As a result of this program, Ariel is able to negotiate the harsh surfzone using fully autonomous distributed gait control. Advancements include the implementation of a high-level controller that recognizes impending unstable trajectories in the phase space of the gait, and adapts accordingly. Separately, a primate-like head was developed for multi-layer visual control of bipedal and quadrupedal robot navigation. The software architecture incorporates cognitive motivations, selective attention, and a suite of reflexive visual routines. the real-time adaptive software architecture developed under this effort is generically applicable to and DoD embedded real-time system.

DTIC

*Real Time Operation; Autonomy; Dynamic Programming; Software Engineering; Architecture (Computers)*

**20020040817** University of Southern California, Dept. of Electrical Engineering, Los Angeles, CA USA

**Robust Control Feedback and Learning Final Report, 1 Oct. 1997-31 Aug. 2001**

Safonov, Michael G.; Nov. 30, 2002; 25p; In English

Contract(s)/Grant(s): F49620-98-1-0026

Report No.(s): AD-A399708; AFRL-SR-BL-TR-02-0095; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The research focused on broadening the class of solvable robust control problems and on developing a firm information theoretic foundation for incorporating the real-time effects of evolving experimental data. Robust control theory concerns the design of control systems capable of robustly maintaining performance to within prescribed tolerances in the face of large-but-bounded modeling uncertainties and nonlinearities. Significant advances were achieved in nonlinear robustness analysis for systems having repeated monotone nonlinearities and in reliable data-driven adaptive control synthesis techniques based on unfalsified control theory. The theory enables design of nonlinear feedback control systems that learn, discover and evolve in order to robustly compensate for battle damage, equipment failures and other changing circumstances.

DTIC

*Aerospace Systems; Control Systems Design; Control Theory*

**20020040887** Analytic Sciences Corp., Arlington, VA USA

**Community Status Report and Proposed Revisions to the JDL Data Fusion Model**

Steinberg, Alan N.; White, Franklin E.; Mar. 03, 1998; 36p; In English

Report No.(s): AD-A399488; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation covers the following topics: 1) Community Status, 2) The Sensor/Data Fusion Working Group, 3) Origins, 4) Status & Problems, 5) Community Ideas and Feedback, 6) The JDL Data Fusion Model, 7) Taxonomy, 8) Functional Model, and 9) Proposed Revisions.

DTIC

*Models; Multisensor Fusion; Tracking (Position)*

## 64

### NUMERICAL ANALYSIS

*Includes iteration, differential and difference equations, and numerical approximation.*

**20020039695** NASA Goddard Space Flight Center, Greenbelt, MD USA

**The Impacts of Daily Surface Forcing in the Upper Ocean over Tropical Pacific: A Numerical Study**

Sui, C.-H., NASA Goddard Space Flight Center, USA; Rienecker, Michele M., NASA Goddard Space Flight Center, USA; Li, Xiaofan, National Environmental Satellite Service, USA; Lau, William K.-M., NASA Goddard Space Flight Center, USA; Laszlo, Istvan, National Environmental Satellite Service, USA; Pinker, Rachel T., Maryland Univ., USA; Jul. 31, 2001; 36p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Tropical Pacific Ocean is an important region that affects global climate. How the ocean responds to the atmospheric surface forcing (surface radiative, heat and momentum fluxes) is a major topic in oceanographic research community. The ocean becomes warm when more heat flux puts into the ocean. The monthly mean forcing has been used in the past years since daily forcing was unavailable due to the lack of observations. The daily forcing is now available from the satellite measurements. This study investigates the response of the upper ocean over tropical Pacific to the daily atmospheric surface forcing. The ocean surface heat budgets are calculated to determine the important processes for the oceanic response. The differences of oceanic responses between the eastern and western Pacific are intensively discussed.

Author

*Climatology; Heat Flux; Ocean Surface; Tropical Regions; Numerical Analysis*

**20020039977** NASA Ames Research Center, Moffett Field, CA USA

**Numerical Methods Using B-Splines**

Shariff, Karim, NASA Ames Research Center, USA; [1997]; 1p; In English, 7 Feb. 1997, Pasadena, CA, USA

Contract(s)/Grant(s): RTOP 505-59-53; No Copyright; Avail: Issuing Activity; Abstract Only

The seminar will discuss (1) The current range of applications for which B-spline schemes may be appropriate (2) The property of high-resolution and the relationship between B-spline and compact schemes (3) Comparison between finite-element,

Hermite finite element and B-spline schemes (4) Mesh embedding using B-splines (5) A method for the incompressible Navier-Stokes equations in curvilinear coordinates using divergence-free expansions.

Author

*Numerical Analysis; Splines; Computational Grids; Spherical Coordinates*

**20020040097** Arizona Univ., Dept. of Mathematics, Tucson, AZ USA

**Modelling Swell High Frequency Spectral and Wave Breaking Final Report**

Zakharov, V. E.; Feb. 15, 2002; 226p; In English

Contract(s)/Grant(s): N00014-98-1-0070

Report No.(s): AD-A399213; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

My long-term goal was development of a self-consistent analytical, dynamical and statistical theory of weak and strong nonlinear interactions in ocean gravity waves. The theory should be supported by the extensive numerical simulations as well as by laboratory experiments and field observations. The theory will be used as a basis for development of approximate models of Snl, which can be used in a new generation of operational models for wave forecasting. Another goal is the development of the theory of wave breaking which will make it possible to find a well-justified estimate for the rate of energy dissipation due to this process. The level of nonlinearity in an ensemble of wind-driven ocean waves is relatively small. It makes it possible to apply for its statistical description the theory of weak turbulence. In the most simple case, it is the theory of kinetic (Hasselmann's) equation for spectra of the normalized wave action. The kinetic equation has a remarkable family of exact stationary Kolmogorov-type solutions. They are governed by two parameters: fluxes of energy and momentum to the region of high wave numbers, and can be applied for description of energy spectra in the "universal" range behind the spectral peak. All Kolmogorov spectra have asymptotics  $E(w)$  similar or equal  $w^{-4}$  after averaging in angle. The exact kinetic equation is too complicated to be used in the operational model of wave prediction. Thus, the development of its approximate models is an actual problem. The wave-breaking, which in most cases participate in the wave dynamics is a strongly nonlinear process, makes an important contribution to energy dissipation. So far, there is no reliable theory for this phenomenon. I combine in my work the analytical methods of mathematical physics with massive numerical simulation and construction of simple phenomenological models. All results are compared with laboratory experiments and field observations.

DTIC

*Water Waves; Sea Floor Spreading; Gravity Waves*

**20020040382** Association Francaise de Approximation, France

**International Conference on Curves and Surfaces, Volume 2, Curve and Surface Fitting**

Cohen, Albert; Rabut, Christophe; Schumaker, Larry L.; Apr. 2000; 442p; In English; International Conference on Curves and Surfaces (4th), 1-7 Jul. 1999, Saint-Malo, France; For individual articles, see ADP011967 thru ADP012009

Contract(s)/Grant(s): F61775-99-W-F068

Report No.(s): AD-A399401; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

This volume contains papers presented at the 4th International Conference on Curves and Surfaces held in Saint-Malo, France on 1-7 July 1999. The companion Volume 1: Curve and Surface Design, contains 45 papers. The conference presents the classical domain of Approximation Theory (interpolation, smoothing techniques, splines, radial basis functions, wavelets) as well as more technical aspects of geometric modeling, computer-aided design and mechanics.

DTIC

*Conferences; Approximation; Interpolation*

**20020040393** Raytheon Systems Co., Tucson, AZ USA

**Advanced Mathematics for Missile Seeker Signal Processing Final Report, Jul. 1998-31 Dec. 2001**

Braunreiter, Dennis; Dec. 20, 2001; 92p; In English

Contract(s)/Grant(s): F49620-98-C-0034

Report No.(s): AD-A399434; AFRL-SR-BL-TR-02-0036; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This final report summarizes progress toward accomplishment of contractual objectives during the 42-month period covering 1 July 1998 through 31 December 2001. While somewhat arbitrary, it is convenient to break the contract into two periods of performance. We refer to the first period of performance as the Base Program. It covered 33 months from 1 July 1998 to 3 March 2001 and had a funding level of \$2,400,000. The Base Program concentrated on radar signal processing and had an objective of using advanced mathematics to improve radar adaptive array processing (AAP). We refer to the second period of performance as the Option Program. It covered 9 months from 1 April 2001 to 31 December 2001 and had a funding level of \$640,000. The

Option Program concentrated on optical signal processing and had an objective of applying advanced mathematics algorithms developed by various contractors under DARPA DSO ACMP to uncooled JR (UCIR) sensors.

DTIC

*Signal Processing; Radar*

**20020040404** Association Francaise de Approximation, France

**International Conference on Curves and Surfaces (4th), Saint-Malo, France, 1-7 July 1999. Proceedings, Volume 1. Curve and Surface Design**

Laurent, Pierre-Jean; Sablonniere, Paul; Schumaker, Larry L.; Apr. 2000; 460p; In English; For individual articles, see ADP012010 thru ADP012054

Contract(s)/Grant(s): F61775-99-W-F068

Report No.(s): AD-A399461; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

This volume contains 45 papers presented at the 4th International Conference on Curves and Surfaces held in Saint-Malo, France on 1-7 July 1999. The companion Volume 2: Curve and Surface Fitting, contains 43 papers. The conference presents the classical domain of Approximation Theory (interpolation, smoothing techniques, splines, radial basis functions, wavelets) as well as more technical aspects of geometric modeling, computer-aided design and mechanics.

DTIC

*Numerical Analysis; Interpolation; Approximation; Wavelet Analysis; Conferences*

**20020040844** NASA Ames Research Center, Moffett Field, CA USA

**Finding New Math Identities by Computer**

Bailey, David H., NASA Ames Research Center, USA; [1996]; 1p; In English, 29 Jan. 1997, Portland, OR, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Recently a number of interesting new mathematical identities have been discovered by means of numerical searches on high performance computers, using some newly discovered algorithms. These include the following:  $\pi = ((\sup_{k=0}^{\infty}) (\Sigma (1/16)^k ((4/8k+1) - (2/8k+4) - (1/8k+5) - (1/8k+6)))$  and  $((17\pi(\exp 4))/360) = ((\sup_{k=1}^{\infty}) (\Sigma (1 + (1/2) + (1/3) + \dots + (1/k))(\exp 2)^k (\exp -2)))$ ,  $\zeta(3, 1, 3, 1, \dots, 3, 1) = (2\pi(\exp 4m)/(4m+2)!)$  where  $m = \text{number of } (3,1) \text{ pairs. and where } \zeta(n_1, n_2, \dots, n_r) = (\sup_{k_1} (\text{is greater than } k_2 (\text{is greater than } \dots (\text{is greater than } k_r) (\Sigma (1/(k_1 (\sup_{n_1} k_2 (\sup_{n_2} \dots k_r (\sup_{n_r}))$ ). The first identity is remarkable in that it permits one to compute the  $n$ -th binary or hexadecimal digit of  $\pi$  directly, without computing any of the previous digits, and without using multiple precision arithmetic. Recently the ten billionth hexadecimal digit of  $\pi$  was computed using this formula. The third identity has connections to quantum field theory. (The first and second of these been formally established; the third is affirmed by numerical evidence only.) The background and results of this work will be described, including an overview of the algorithms and computer techniques used in these studies.

Author

*Algorithms; Computer Techniques; Identities*

**20020040878** Defence Science and Technology Organisation, Victoria, Australia

**Determining Beam Bending Distribution Using Dynamic Information**

Polanco, Frank G.; Jan. 2002; 48p; In English

Report No.(s): AD-A399357; DSTO-RR-0226; DODA-AR-012-097; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As a first approximation, a helicopter rotor blade may be modelled as a cantilever beam. Given the initial deformation of this beam, and using either strain or acceleration at one location along the beam, we can determine the load distribution along the entire beam. We consider load distributions that can vary spatially, but are constant in time (except for the initial step input). In the solution we neglect the effects of both aerodynamic and mechanical damping. The separation of variables technique leads to a solution in terms of the beam's natural modes. The loading distribution is decomposed in terms of these modes. A finite element simulation of the beam's response to a cubic load distribution verifies that this load prediction is possible. We demonstrate that the higher modes of the load prediction are unstable when noise is present in the measurements, but that the lower modes are robust. If the initial beam deformation is unknown, then additional (strain or vibration) measurement locations may be substituted for the unknown initial deformation.

DTIC

*Cantilever Beams; Deformation; Rotary Wings; Aerodynamic Loads*

**20020040894** NASA Ames Research Center, Moffett Field, CA USA

**Recent Progress in Parallel Schur Complement Preconditioning for Computational Fluid**

Barth, Tim, NASA Ames Research Center, USA; [1997]; 1p; In English, 24 Jan. - 2 Feb. 1997, Waterloo, Canada; Copyright; Avail: Issuing Activity; Abstract Only

We consider preconditioning methods for nonself-adjoint advective-diffusive systems based on a nonoverlapping Schur complement procedure for arbitrary triangulated domains. The triangulation is first partitioned using the METIS multi-level \$k\$-way partitioning code. This partitioning of the triangulation induces a natural 2x2 partitioning of the demoralization matrix. By considering various inverse approximations of the 2x2 system we have developed a family of robust preconditioning techniques. The performance of these approximations will be discussed and numerous examples shown to illustrate the efficiency of the technique.

Author

*Triangulation; Adjoints; Discretization (Mathematics)*

**20020040899** Sterling Software, Inc., Moffett Field, CA USA

**Overset Grid Methods for Multidisciplinary Applications in Rotorcraft Problems**

Ahmad, J. U., Sterling Software, Inc., USA; [1996]; 1p; In English; 3rd Symposium on Overset Grid, 18-20 Nov. 1996, Los Alamos, NM, USA

Contract(s)/Grant(s): RTOP 505-59-36; No Copyright; Avail: Issuing Activity; Abstract Only

A methodology for the coupling of an advanced computational fluid dynamics method based on an overset grid flow-solver and an advanced computational structural dynamics method based on a finite element analysis is presented. Various procedures for the fluid-structure interactions modeling along with their limitations are also discussed. The flight test data for the four-bladed UH-60A Blackhawk helicopter rotor is chosen for the validation of the results. Convergence and accuracy are tested by numerical experiments with a single-bladed rotor. A comparison of airload predictions with flight test data as well as with a rigid blade case is presented. Grid and interpolation related issues for this aeroelastic application are described.

Author

*Computational Fluid Dynamics; Rotary Wing Aircraft; Computational Grids; Dynamic Structural Analysis; Aeroelasticity*

**20020040903** MCAT Inst., Moffett Field, CA USA

**Hyperbolic Methods for Surface and Field Grid Generation**

Chan, William M., MCAT Inst., USA; [1996]; 1p; In English

Contract(s)/Grant(s): NAS2-14109; RTOP 505-59-53; No Copyright; Avail: Issuing Activity; Abstract Only

This chapter describes the use of hyperbolic partial differential equation methods for structured surface grid generation and field grid generation. While the surface grid generation equations are inherently three dimensional, the field grid generation equations can be formulated in two or three dimensions. The governing equations are derived from orthogonality relations and cell area/volume constraints; and are solved numerically by marching from an initial curve or surface. The marching step size and marching distance can be prescribed by the user. Exact specifications of the side and outer boundaries are not possible with a one sweep marching scheme but limited control is achievable. Excellent orthogonality and grid clustering characteristics are provided by hyperbolic methods with one to two orders of magnitude savings in time over typical elliptic methods. Since hyperbolic grid generation methods do not require the exact specifications of the side and outer boundaries of a grid, these methods are particularly well suited for the overlapping grid approach for solving problems on complex configurations. Grid generation software based on hyperbolic methods and their applications on several complex configurations will be described.

Author

*Hyperbolic Differential Equations; Grid Generation (Mathematics); Structured Grids (Mathematics)*

## 65

### STATISTICS AND PROBABILITY

*Includes data sampling and smoothing; Monte Carlo method; time series and analysis; and stochastic processes.*

**20020039909** NASA Glenn Research Center, Cleveland, OH USA

**Software for Statistical Analysis of Weibull Distributions with Application to Gear Fatigue Data: User Manual with Verification**

Kranz, Timothy L.; Jan. 2002; 36p; In English

Contract(s)/Grant(s): RTOP 712-50-13; DA Proj. 1L1-62211-A-47-A

Report No.(s): NASA/TM-2002-211109; NAS 1.15:211109; E-12956; AD-A398907; ARL-TR-1338; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Weibull distribution has been widely adopted for the statistical description and inference of fatigue data. This document provides user instructions, examples, and verification for software to analyze gear fatigue test data. The software was developed presuming the data are adequately modeled using a two-parameter Weibull distribution. The calculations are based on likelihood methods, and the approach taken is valid for data that include type I censoring. The software was verified by reproducing results published by others.

DTIC

*Computer Programs; Weibull Density Functions; Gears; Fatigue Tests*

**20020040112** Naval Undersea Warfare Center, Newport, RI USA

**Joint Probability Density Function of Selected Order Statistics and the Sum of the Remaining Random Variables Progress Report**

Nuttall, Albert H.; Jan. 15, 2002; 39p; In English

Report No.(s): AD-A399298; NUWC-NPT-TR-11; 345; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A set of  $N$  independent, identically distributed random variables  $\{X(\text{sub } n)\}$ , with common probability density function  $p(x)$ , are ordered into a new set of dependent random variables  $\{X'(\text{sub } n)\}$ , each with a different probability density function. From this latter set, the  $n_1$ -th largest random variable through the  $n(\text{sub } M-1)$ -th largest random variable are selected. Then, the sum of the remaining  $N+1-M$  random variables is computed, giving a total of  $M$  dependent random variables. The joint probability density function of these  $M$  random variables is derived in a form involving a single Bromwich contour integral in the moment-generating function domain. The integral is most easily numerically evaluated by locating (approximately) the real saddlepoint of the integrand and passing the contour through this point. Very high accuracy in the probability density function evaluation is available by using numerical integration instead of a saddlepoint approximation.

DTIC

*Random Variables; Probability Density Functions; Statistical Analysis; Probability Theory; Contours; Independent Variables*

**20020040885** Pacific-Sierra Research Corp., Arlington, VA USA

**Representing and Scoring Track Hypotheses for Multitarget groups**

Hastings, Charles H.; Withers, Langhorne P., Jr.; DeWitt, Ronald N.; Mar. 13, 1998; 13p; In English; Original contains color images

Report No.(s): AD-A399490; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents an economical method for representing track sets for observations of possibly unstable groups of vehicles, and an algorithm to create and update the multi-vehicle track association hypotheses. We represent bundles of tracks to avoid redundant computing, but we remember to multiply our track scores by how many individual target tracks are being represented. This paper is divided into two main parts. The first part describes representing these bundles of tracks efficiently and the related logic of track extension for multi-target observations. to begin, we consider the combinatorial explosion of association hypotheses for tracking groups of target objects that may split or merge. For a population of 10 targets, if five are observed in one spot and then three are observed in another spot, there are 9, 072,000 track combinations represented and covered by a single update. However, as we will show, all of these equivalent possibilities can be represented as a single track or track bundle. We count the combinations represented by one multitrack, then we multiply the single-thread track score times the number of threads represented to get the total probability represented. We will derive a formula for the multitrack score update. The second part of the paper describes an algorithm for extending and initiating multitracks. The algorithm for extending and initiating multitracks is an enhancement of the PSR Tracker Multi- Hypothesis Manager algorithm with pruning. However, where the old algorithm constructed all valid hypotheses for a new observation and then pruned, the new algorithm uses a least cost branch and bound technique to create only those hypotheses likely to survive the pruning process. This results in a significant reduction in the number of hypotheses generated.

DTIC

*Combinatorial Analysis; Target Recognition; Multiple Target Tracking*

**20020040886** Boeing Information, Space and Defense Systems, Seattle, WA USA

**Data Fusion Within a Constrained Communication Environment**

Lobbia, Robert N.; Owen, Mark; Feb. 1998; 10p; In English

Report No.(s): AD-A399489; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents some recent results involving track level fusion in a distributed tracking environment. Successful fusion for the application requires that target state estimates and their error covariance matrices be available for processing. For this study, the limitations associated with several of the existing communication links (missing covariance) and how we can recover track covariance matrices from track quality parameters, are being dealt with. An algorithm for reconstructing an error covariance from an offboard track system is presented using the notion of an ambiguous measurement set. The performance of this approach is demonstrated in several simulated test cases.

DTIC

*Communication Networks; Multisensor Fusion; Target Recognition*

## 66

### SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

*Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.*

**20020039955** Science Applications International Corp., Schaumburg, IL USA

#### **Systems Integration, Analysis and Modeling Support to the HEDS Technology/Commercialization Initiative (HTCI) Final Report**

Feingold, Harvey, Science Applications International Corp., USA; April 2002; 54p; In English

Contract(s)/Grant(s): NASA Order H-33234-D; SAIC Proj. 06-0120-04-9754-000

Report No.(s): SAIC-02/1031; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In response to a recommendation from OMB, NASA's Fiscal Year 2001 budget included a new program within the HEDS (Human Exploration and Development of Space) Enterprise called HEDS Technology/ Commercialization Initiative (HTCI). HTCI had three overarching goals: to support REDS analysis and planning for safe, affordable and effective future programs and projects that advance human exploration, scientific discovery, and the commercial development of space; to pursue research, development, and validation of breakthrough technologies and highly innovative systems concepts; and to advance the creation of strong partnerships within NASA, with U.S. industry and universities, and internationally. As part of its contracted effort, SAIC was to write a report contribution, describing the results of its task activities, to a final HTCI report prepared by MSFC. Unfortunately, government cancellation of the HTCI program in the summer of 2001 curtailed all efforts on the program including the Final HTCI report. In the absence of that report, SAIC has issued this final report in an attempt to document some of the technical material it produced. The report contains SAIC presentations for both HTCI workshops; a set of roadmap charts for the Systems Analysis, Integration and Modeling; and charts showing the evolution of the current TITAN modeling architecture.

Author

*Space Commercialization; Technology Utilization; Systems Analysis; Systems Integration; Space Exploration*

**20020040100** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

#### **OCTAVEsm Criteria, Version 2.0 Final Report**

Alberts, Christopher J.; Dorofee, Audrey J.; Dec. 2001; 141p; In English

Contract(s)/Grant(s): F10629-00-C-0003

Report No.(s): AD-A399229; CMU/SEI-2001-TR-016; ESC-TR-2001-016; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Today, we rely on access to digital data that are accessible, dependable, and protected from misuse. Unfortunately, this need for accessible data also exposes organizations to a variety of new threats that can affect their information. The Operationally Critical Threat, Asset, and Vulnerability Evaluation(Service Mark) (OCTAVE(Service Mark)) enables organizations to understand and address their information security risks. OCTAVE is led by a small, interdisciplinary team of an organization's personnel and focuses on an organization's assets and the risks to those assets. It is a comprehensive, systematic, context-driven, and self-directed evaluation approach. The essential elements of the OCTAVE approach are embodied in a set of criteria that define the requirements for OCTAVE. This report describes the OCTAVE criteria. The goal of this report is to define a general approach for evaluating and managing information security risks. Organizations can then develop methods that are consistent with the OCTAVE criteria.

DTIC

*Risk; Security; Computer Information Security*

**20020040325** Bevilacqua Research Corp., Huntsville, AL USA

**Dependency Language Representation Using Conceptual Graphs. Autonomic Information Systems Final Report, 19 Sep. 2000-22 Aug. 2001**

Delugach, Harry S.; Cox, Lissa C.; Skipper, David J.; Aug. 22, 2001; 83p; In English

Contract(s)/Grant(s): F33615-00-C-1742

Report No.(s): AD-A399504; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This study is founded on the assumption that understanding the complex dependencies in large mission critical systems is a requirement for predictable, safe long-term operation of such systems. In the absence of a standardized language to represent dependencies, this study investigates Conceptual Graphs to determine if they are capable of representing dependencies and if they show traits that make them a suitable representation for dependencies. The fundamental issue was developing a definition of dependencies among system and software components, then finding suitable representations of the definition. This is a precursor to developing a formal language for dependencies.

DTIC

*Programming Languages; Systems Analysis; Standardization; Graphs (Charts)*

**20020040390** Army Research Lab., Survivability/Lethality Analysis Directorate, White Sands Missile Range, NM USA

**Reflexive IW Model II Final Report**

Lefebvre, Vladimir A.; Reader, Thomas W.; Feb. 2002; 50p; In English

Report No.(s): AD-A399417; ARL-SR-114; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The results of advancing the use of reflexive processes in a multiple agent environment are presented. Emphasis is placed on a mathematical representation.

DTIC

*Artificial Intelligence; Mathematical Models*

**20020040559** Center for Army Analysis, Fort Belvoir, VA USA

**Revolution in Analytical Affairs - XXI Final Report, Nov. 1997-May 2001**

Shedlowski, Daniel J.; Shaffer, Dave; Fratzel, Margaret; May 2001; 46p; In English

Report No.(s): AD-A399181; CAA-R-01-23; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses how the Army analysis community should change to improve its capability to meet the present and future analytical demands of its analysis customers. At the November 1997 Army Operations Research Symposium, LTG Heebner highlighted the ongoing revolution in business and military affairs and questioned whether there is or should be a corresponding revolution in analytical affairs. To answer LTG Heebner's inquiry, general officer level Army commanders and heads of major staff elements were interviewed to develop a description of customer analysis demands. Major post-Cold War changes in the analysis community were identified. Based on this information, along with an understanding of the underpinnings of current counterpart revolutionary changes in government, military, and commercial sectors, a proposal was developed for a revolutionary change in the Army analysis community proposal that is distinctly customer focused. This report discusses this proposed revolutionary change along with other supporting initiatives.

DTIC

*Operations Research; Conferences; Defense Program*

## 70

### PHYSICS (GENERAL)

*Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see categories 71 through 77. For related instrumentation see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.*

**20020039337** NASA Kennedy Space Center, Cocoa Beach, FL USA

**Dynamics of a Finite Liquid Oxygen (LOX) Column in a Pulsed Magnetic Field**

Youngquist, Robert, NASA Kennedy Space Center, USA; Immer, Christopher, DYNACS Engineering Co., Inc., USA; Lane, John, DYNACS Engineering Co., Inc., USA; Simpson, James, DYNACS Engineering Co., Inc., USA; [2002]; 11p; In English

Contract(s)/Grant(s): NAS10-98001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

It is well known that liquid oxygen has a sufficient paramagnetic susceptibility that a strong magnetic field gradient can lift it in the earth's gravitational field. The movement of liquid oxygen is vital to the space program since it one of the primary oxidizers

used for propulsion. Transport of liquid oxygen (LOX) via direct interaction of the magnetic fields (B field) with the fluid is a current topic of research and development at Kennedy Space Center, FL. This method of transporting (i.e. pumping) LOX may have particular advantages on Mars and other reduced gravitational environments, namely safety and reliability. This paper will address transport of a magnetic fluid, LOX, via phased-pulsed electromagnets acting on the edge of the column of fluid. The authors have developed a physical model from first-principles for the motion of a magnetic fluid in a particular U-tube geometry subjected to a pulsed magnetic field from an arbitrary solenoidal electromagnet. Experimental data that have been collected from the analogous geometry correlate well to that of the ab-initio calculations.

Derived from text

*Liquid Oxygen; Magnetic Fields; Gravitational Fields; Electromagnets; Gradients; Manometers*

**20020039535** NASA Ames Research Center, Moffett Field, CA USA

**On Kinetics Modeling of Vibrational Energy Transfer**

Gilmore, John O., Stanford Univ., USA; Sharma, Surendra P., NASA Ames Research Center, USA; [1996]; 1p; In English  
Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

Two models of vibrational energy exchange are compared at equilibrium to the elementary vibrational exchange reaction for a binary mixture. The first model, non-linear in the species vibrational energies, was derived by Schwartz, Slawsky, and Herzfeld (SSH) by considering the detailed kinetics of vibrational energy levels. This model recovers the result demanded at equilibrium by the elementary reaction. The second model is more recent, and is gaining use in certain areas of computational fluid dynamics. This model, linear in the species vibrational energies, is shown not to recover the required equilibrium result. Further, this more recent model is inconsistent with its suggested rate constants in that those rate constants were inferred from measurements by using the SSH model to reduce the data. The non-linear versus linear nature of these two models can lead to significant differences in vibrational energy coupling. Use of the contemporary model may lead to significant misconceptions, especially when integrated in computer codes considering multiple energy coupling mechanisms.

Author

*Energy Transfer; Kinetics; Vibration; Mathematical Models*

**20020040063** Air Force Research Lab., Directed Energy Directorate, Kirkland AFB, NM USA

**Electromagnetic Code Consortium Benchmarks Final Report, 1 May 2001-5 Dec. 2001**

Greenwood, Andrew; Dec. 2001; 18p; In English; Original contains color images

Contract(s)/Grant(s): AF Proj. 4867

Report No.(s): AD-A399280; AFRL-DE-TR-2001-1086; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Several additions to the metallic Electromagnetic Code Consortium (EMCC) benchmarks are described. The new geometries include a cube, a prism, a pyramid and a trihedron. These geometries include edge, corner, and multipath scattering effects. In addition, the first EMCC antenna benchmark composed of an array of elements on a finite metal plate is described. Measured and computed scattering or radiation data for each new geometry is shown. Computed data is generated with the FISC, AIM, and XPATCH codes. Where applicable, sources of discrepancy between the measured and computed results are discussed. For some of the objects, the measured data is taken in two passes to improve the dynamic range. However, at present only one pass of the data is available, resulting in some error near the top or the bottom of the data range.

DTIC

*Computerized Simulation; Electromagnetic Scattering*

**20020040081** Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA

**Effect of Panting on the Fatigue Strength of Ship Plating Final Report**

Kihl, David P.; Oct. 2001; 179p; In English

Contract(s)/Grant(s): Proj-PE62121N

Report No.(s): AD-A399387; NSWCCD-65-TR-2001/27; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Panting is the name given to out-of plane movement and formation of secondary bending stresses which are produced when a deformed panel is subjected to in-plane edge loads. The role of panting, particularly as it applies to fatigue, is essentially unquantified. There have been reported incidences where fuel/ballast tank tops have cracked as a result of sloshing and pressure fluctuation between adjoining tanks. However, recent interest in advanced unidirectional double hull concepts for both naval and commercial ships has generated interest in the effects of panting on the fatigue strength of these types of ships. The intent of this investigation is to quantify the additional fatigue damage and associated reduction in fatigue life of a plate panel, which can be attributed to panting. These fatigue analyses considered the interaction of axial load and lateral pressure and established a fatigue

analysis procedure where none had previously existed. These results help to identify acceptable aspect and slenderness ratios of plate panels, as well as ratios which should be avoided.

DTIC

*Fatigue (Materials); Hulls (Structures); Pressure Oscillations; Deformation; Fuel Tanks*

**20020040780** Oak Ridge National Lab., TN USA

**Proton Emission from Gamow Resonance**

Vertse, T., Oak Ridge National Lab., USA; Oct. 19, 2001; 6p; In English

Report No.(s): DE2002-788694; P01-112229; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We demonstrated that it is possible to calculate the complex energy of the deformed Gamow state with a precision that is high enough so that the half-life calculated from the imaginary part of the energy is meaningful. We also performed a comparison between non-adiabatic and adiabatic calculations. It can be concluded that, in many cases, the corrected adiabatic treatment cannot be used as a substitute for the full non-adiabatic calculations.

NTIS

*Proton Resonance; Computation; Emission*

**20020040781** Oak Ridge National Lab., TN USA

**Light-Fronts Approach to a Two-Center Time-Dependent Dirac Equation**

Segev, B., Oak Ridge National Lab., USA; Nov. 01, 2001; 26p; In English

Report No.(s): DE2002-788696; P01-112022; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Consider the relativistic scattering problem of an electron in the external field of two point-like charges (ions), moving on parallel, straight-line trajectories in opposite directions at speeds which approach the speed of light, and at an impact parameter  $2b$ . An external-field approach to the influence of the ions on the electron is appropriate for peripheral impact parameters, heavy-ions, and high energies, where, to a very good approximation, the ions travel on parallel, straight-line trajectories, and ion recoil is negligible. We review here our recent work on this problem. In section 2, following Ref. (2), we show that the two center time dependent Dirac equation for the electron reduces in the high energy limit to Eq. (26) with the interactions of Eq. (29). In section 3, following Ref. (1), we solve this equation off the light fronts i.e. for an electron that both initially and asymptotically is not co-moving with an ion. The main result of our work is the transition amplitude given by Eqs. (90) and (67). In section 4, we discuss the application of this solution to electromagnetic pair production in heavy ion collisions, which we have used, for example, in Ref. (3), to explain recent experimental results. We note that one should distinguish between electron-positron pairs produced so that they are co-moving with the ions and those that are not. The two cases differ experimentally. They also differ theoretically, because they are described by different asymptotic boundary conditions. We have solved the problem only for electron-positron pairs that are not co-moving with the ions. Our solution to the two center Dirac equation in the high energy limit was confirmed by different methods, including a Green function approach (4), and resummation of the perturbation series (5). The application to pair production on the other hand, has raised some controversy, which is also discussed in section 4. Section 5 concludes.

NTIS

*Boundary Conditions; Dirac Equation; Electron-Positron Pairs*

**20020040787** Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

**Solid State Research Quarterly Report, 1 May-31 Jul. 2001**

Shaver, David C.; Aug. 15, 2001; 74p; In English; Original contains color images

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): AD-A399475; 2001:3; ESC-TR-2001-048; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report covers in detail the research work of the Solid State Division at Lincoln Laboratory for the period 1 May through 31 July 2001. The topics covered are Quantum Electronics, Electro-optical Materials and Devices, Submicrometer Technology, Biosensor and Molecular Technologies, Advanced Imaging Technology, Analog Device Technology, and Advanced Silicon Technology. Funding is provided by several DoD organizations-including the Air Force, Army, BMDO, DARPA, Navy, NSA, and OSD-and also by the DOE, NASA, and MST.

DTIC

*Quantum Electronics; Optoelectronic Devices; Solid State Devices*

**20020040831** National Renewable Energy Lab., Golden, CO USA

**Theoretical Study of Doping Limits of CdTe: Preprint**

Wei, S. H.; Zhang, S. B.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000020; NREL/CP-590-31012; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: A theoretical study of the doping limits of CdTe.

NTIS

*Cadmium Tellurides; Additives*

**20020040832** National Renewable Energy Lab., Golden, CO USA

**Evaluation of NF<sub>3</sub> versus Dimethylhydrazine as N sources for GaAsN: Preprint**

Kurtz, S.; Reedy, R.; Keyes, B.; Barber, G.; Geisz, J.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000009; NREL/CP-520-30983; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Evaluation of NF<sub>3</sub> versus Dimethylhydrazine as N sources for GaAsN.

NTIS

*Dimethylhydrazines; Nitrogen Fluorides; Gallium Arsenides*

**20020040893** Department of Energy, Washington, DC USA

**HEPAP white paper on planning for u.s. high-energy physics (high energy physics advisory panel)**

Oct. 01, 2000; 48p

Report No.(s): DE2002-771000; DOE/SC-0027; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

High-energy physicists seek to understand what the universe is made of, how it works, and where it has come from. They investigate the most basic particles and the forces between them. Experiments and theoretical insights over the past several decades have made it possible to see the deep connection between apparently unrelated phenomena, and to piece together more of the story of how a rich and complex cosmos could evolve from just a few kinds of elementary particles. The 1998 Subpanel of the High Energy Physics Advisory Panel (HEPAP) laid out a strategy for U.S. high-energy physics for the next decade. That strategy balanced exciting near-term opportunities with preparations for the most important discovery possibilities in the longer-term. Difficult choices were made to end several highly productive programs and to reduce others. This year HEPAP was charged to take the plan given in the Subpanel's report, understand it in the context of worldwide progress, and update it. In response to that charge, this White Paper provides an assessment of where we stand, states the next steps to take in the intermediate term, and serves as input for a longer range planning process involving a new HEPAP subpanel and high-energy physics community evaluation in 2001. Since the 1998 Subpanel, there have been important developments and a number of the Subpanel's recommendations have been implemented. Notably, construction of the B-factory at SLAC, the Main Injector at Fermilab, and the upgrade of CESR at Cornell have all been finished on schedule and on budget. We have gained great confidence in the performance of these accelerators and the associated detectors. The B-factory at SLAC is already operating above design luminosity and plans are in place to reach three times the design in the next few years. In addition, there have been major physics developments that lead us to believe that these completed projects are guaranteed to produce frontier physics results and have an enhanced potential for a truly major breakthrough. However, taking advantage of these facilities requires greater funding for operations than the significantly reduced level of the last several years.

NTIS

*Particle Accelerators; High Energy Interactions*

## 71 ACOUSTICS

*Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution. For aircraft noise see also 02 Aerodynamics and 07 Aircraft Propulsion Propulsion and Power.*

**20020039715** NASA Ames Research Center, Moffett Field, CA USA

### **Virtual Acoustics: Evaluation of Psychoacoustic Parameters**

Begault, Durand R., NASA Ames Research Center, USA; [1997]; 1p; In English; 3-D Sound Workshop, 6 Feb. 1997, Paris, Aizu, France, Japan

Contract(s)/Grant(s): RTOP 199-06-12; No Copyright; Avail: Issuing Activity; Abstract Only

Current virtual acoustic displays for teleconferencing and virtual reality are usually limited to very simple or non-existent renderings of reverberation, a fundamental part of the acoustic environmental context that is encountered in day-to-day hearing. Several research efforts have produced results that suggest that environmental cues dramatically improve perceptual performance within virtual acoustic displays, and that is possible to manipulate signal processing parameters to effectively reproduce important aspects of virtual acoustic perception in real-time. However, the computational resources for rendering reverberation remain formidable. Our efforts at NASA Ames have been focused using a several perceptual threshold metrics, to determine how various "trade-offs" might be made in real-time acoustic rendering. This includes both original work and confirmation of existing data that was obtained in real rather than virtual environments. The talk will consider the importance of using individualized versus generalized pinnae cues (the "Head-Related Transfer Function"); the use of head movement cues; threshold data for early reflections and late reverberation; and consideration of the necessary accuracy for measuring and rendering octave-band absorption characteristics of various wall surfaces. In addition, a consideration of the analysis-synthesis of the reverberation within "everyday spaces" (offices, conference rooms) will be contrasted to the commonly used paradigm of concert hall spaces.

Author

*Virtual Reality; Acoustic Properties; Reverberation; Hearing; Signal Processing*

**20020039721** NASA Ames Research Center, Moffett Field, CA USA

### **An Introduction to 3-D Sound**

Begault, Durand R., NASA Ames Research Center, USA; [1997]; 1p; In English; Sponsored by Telecom, Inc., Unknown

Contract(s)/Grant(s): RTOP 199-06-12; No Copyright; Avail: Issuing Activity; Abstract Only

This talk will overview the basic technologies related to the creation of virtual acoustic images, and the potential of including spatial auditory displays in human-machine interfaces. Research into the perceptual error inherent in both natural and virtual spatial hearing is reviewed, since the formation of improved technologies is tied to psychoacoustic research. This includes a discussion of Head Related Transfer Function (HRTF) measurement techniques (the HRTF provides important perceptual cues within a virtual acoustic display). Many commercial applications of virtual acoustics have so far focused on games and entertainment; in this review, other types of applications are examined, including aeronautic safety, voice communications, virtual reality, and room acoustic simulation. In particular, the notion that realistic simulation is optimized within a virtual acoustic display when head motion and reverberation cues are included within a perceptual model.

Author

*Acoustic Properties; Transfer Functions; Virtual Reality; Acoustic Simulation; Reverberation; Voice Communication*

**20020039843** San Jose State Univ., Flight Management and Human Factors Research Div., CA USA

### **Virtual Acoustics, Aeronautics and Communications**

Begault, Durand R., San Jose State Univ., USA; [1996]; 1p; In English; Audio Engineering Society 101st Convention, 8-11 Nov. 1996, Los Angeles, CA, USA; Sponsored by Audio Engineering Society, USA

Contract(s)/Grant(s): RTOP 199-16-12-37; No Copyright; Avail: Issuing Activity; Abstract Only

An optimal approach to auditory display design for commercial aircraft would utilize both spatialized ("3-D") audio techniques and active noise cancellation for safer operations. Results from several aircraft simulator studies conducted at NASA Ames Research Center are reviewed, including Traffic alert and Collision Avoidance System (TCAS) warnings, spoken orientation "beacons" for gate identification and collision avoidance on the ground, and hardware for improved speech intelligibility. The implications of hearing loss amongst pilots is also considered.

Author

*Acoustics; Aeronautics; Warning Systems; Auditory Defects; Collision Avoidance*

**20020040103** Army Research Lab., Sensors Directorate, Adelphi, MD USA

**A High Intensity Infrasonic Acoustic Test System**

Boesch, H. E., Jr.; Reiff, Christian G.; Benwell, Bruce T.; Nov. 2001; 64p; In English

Report No.(s): AD-A399241; ARL-TR-2349; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We describe the design, mathematical modeling, construction, and test of an acoustic test system intended to support the performance of high-intensity acoustic effects experiments on large targets at low-sonic to infrasonic frequencies. An early experimental version of the system, HILF1, used a compressed-air source and airflow modulator from the ARL Mobile Acoustic Source (MOAS) and a single-volume Helmholtz resonator test chamber to achieve sound pressure levels (SPL) above 140 dB in a 5-cu m volume. Based on results from this system, a more advanced system, HILF2, was designed and built. HILF2 uses a compressed-air source based on automotive superchargers, a low-impedance airflow modulator, and a two-volume Helmholtz resonator test chamber to achieve sustained high-purity sinusoidal sound pressure levels in excess of 155 dB in a 2.5-cu m test volume at frequencies from 2 to 20 Hz.

DTIC

*Audio Equipment; Infrasonic Frequencies*

**20020040104** Florida Univ., Dept. of Aerospace Engineering, Gainesville, FL USA

**An Anechoic Aeroacoustic Test Facility Final Report, 1 Apr. 2000-31 Mar. 2001**

Cattafesta, Louis N.; Hubner, Paul; Sheplak, Mark; Carroll, Bruce; Nov. 01, 2001; 12p; In English

Contract(s)/Grant(s): F49620-00-1-0235

Report No.(s): AD-A399240; AFRL-SR-BL-TR-02-0044; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The University of Florida has completed the construction of an advanced aeroacoustics testbed to facilitate both existing and future Air Force/DoD research projects. The proposed facility consists of a versatile anechoic chamber processing a test volume of 18' x 16'6" x 7'8" and a low-frequency cutoff of 100 Hz. The facility leverages a recently completed high-pressure air facility to provide supersonic (and subsonic) jet flows. In addition, the chamber has removable floor wedges to provide either anechoic or semi-anechoic test environments. The facility is equipped with a 5 DOF traverse to allow a myriad of detailed flow, noise, and vibration measurements. In particular, the experimental capabilities of this facility include flow measurements via PIV, LDV, and hot-wire anemometry, automated sound-intensity mapping and source localization capabilities via beam forming arrays, and complete surface vibration characterization vibrometry. The facility provides a unique capability to study fundamental aeroacoustic problems and structure-borne noise phenomena. The uniqueness stems from the combination of a low cutoff frequency (100 Hz), large chamber size, a high-speed flow capability, the ability to switch between a semi-and fully-anechoic chamber, and advanced instrumentation flow, acoustic, and vibration measurements. Most existing anechoic chambers, particularly the few available at universities, have only some of these features, thereby limiting their utility.

DTIC

*Acoustic Properties; Aeroacoustics; Anechoic Chambers; Test Facilities*

**20020040562** Scott Polar Research Inst., Cambridge UK

**Further Analysis of UK Submarine Sonar Data for Comparison with Similar US Datasets Final Report, 15 Sep. 1999-14 Sep 2000**

Wadhams, Peter; Sep. 14, 2000; 13p; In English

Contract(s)/Grant(s): N68171-99-M-6643

Report No.(s): AD-A399174; ARDSG-R/D-8922-EN-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The first phase of this process was the comparison of statistical parameters from analyses carried out by degree of latitude, cognizant of the summer collection period of the 1996 cruise. The second phase was a closer examination of instrument differences and how these might influence current selection criteria in statistical analysis. The final phase has been the consolidation of further data from 1976 and 1991 to permit the comparison of the 1996 dataset with earlier data from similar data collection areas in the same season.

DTIC

*Sonar; Statistical Analysis; Data Acquisition; Submarines*

## 72 ATOMIC AND MOLECULAR PHYSICS

*Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 Nuclear Physics.*

**20020039431** NASA Ames Research Center, Moffett Field, CA USA

### **Theoretical Study of Low-Energy Electron-Molecule Collisions**

Huo, Winfred M., NASA Ames Research Center, USA; [1995]; 1p; In English; 48th Annual Gaseous Electronics Conference, 9-13 Oct. 1995, Berkley, CA, USA

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

Polarized studies of electron collisions with carbon tetrafluoride and beryllium carbonyl are reported. In the e-CF<sub>4</sub> study, the resonance structure between 8-9 eV is shown to be a superposition of the T<sub>2</sub><sup>-</sup> and A<sub>1</sub>-symmetry shape resonances. The unequivocal assignment of this feature as a double-resonance structure clarifies certain discrepancies in previous attempts to ascribe the 8-9 eV feature to a shape resonance in one or another partial channel and explains the sensitivities found in the fragment ion production in the resonance region. The Be-CO system is chosen as a prototypical example of an adsorbate-substrate interaction. To understand how bonding with the substrate affects the CO resonance, electron collision with two states of BeCO are studied, one with a very weak van der Waals bond and the other, with a normal chemical bond. It is shown that the nature of the Be-CO bond has strong effects on the cross section feature.

Author

*Molecular Collisions; Beryllium; Carbon Tetrafluoride; Carbonyl Compounds; Chemical Bonds; Electron Scattering*

**20020039529** Alaska Univ., Geophysical Inst., Fairbanks, AK USA

### **Ion Outflow Observations Final Report**

[2002]; 15p; In English

Contract(s)/Grant(s): NAG5-6976; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The characteristics of out-flowing ions have been investigated under various circumstances. In particular the upwelling of ions from the cleft region has been studied to attempt to look at source characteristics (e.g., temperature, altitude). High altitude (6-8 Re) data tend to show ions species that have the same velocity and are adiabatically cooled. Such ions, while representative of their source, can not provide an accurate picture. Ion observations from the TIDE detector on the Polar spacecraft show an energy (or equivalently a velocity) spectrum of ions as they undo the geomagnetic mass spectrometer effect due to convection-gravity separation of the different species. Consolidation of this type of data into a complete representation of the source spectrum can be attempted by building a set of maximum-phase-space- density-velocity pairs and attributing the total to the source.

Author

*Outlet Flow; Velocity Distribution; Ion Distribution; Ion Density (Concentration)*

**20020039542** NASA Ames Research Center, Moffett Field, CA USA

### **Augmenting Transition Probabilities for Neutral Atomic Nitrogen**

Terrazas-Salines, Imelda, NASA Ames Research Center, USA; Park, Chul, NASA Ames Research Center, USA; Strawa, Anthony W., NASA Ames Research Center, USA; [1996]; 1p; In English

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

The transition probability values for a number of neutral atomic nitrogen (NI) lines in the visible wavelength range are determined in order to augment those given in the National Bureau of Standards Tables. These values are determined from experimentation as well as by using the published results of other investigators. The experimental determination of the lines in the 410 to 430 nm range was made from the observation of the emission from the arc column of an arc-heated wind tunnel. The transition probability values of these NI lines are determined to an accuracy of +/- 30% by comparison of their measured intensities with those of the atomic oxygen (OI) multiplet at around 615 nm. The temperature of the emitting medium is determined both using a multiple-layer model, based on a theoretical model of the flow in the arc column, and an empirical single-layer model. The results show that the two models lead to the same values of transition probabilities for the NI lines.

Author

*Nitrogen Atoms; Transition Probabilities*

20020039548 NASA Ames Research Center, Moffett Field, CA USA

**Ab Initio and Improved Empirical Potentials for the Calculation of the Anharmonic Vibrational States and Intramolecular Mode Coupling of N-Methylacetamide**

Gregurick, Susan K., Maryland Univ. Baltimore County, USA; Chaban, Galina M., NASA Ames Research Center, USA; Gerber, R. Benny, Hebrew Univ., Israel; [2001]; 27p; In English

Contract(s)/Grant(s): NSF MCB-99-82629; RTOP 274-50-00-06; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The second-order Moller-Plesset ab initio electronic structure method is used to compute points for the anharmonic mode-coupled potential energy surface of N-methylacetamide (NMA) in the trans configuration, including all degrees of freedom. The vibrational states and the spectroscopy are directly computed from this potential surface using the Correlation Corrected Vibrational Self-Consistent Field (CC-VSCF) method. The results are compared with CC-VSCF calculations using both the standard and improved empirical Amber-like force fields and available low temperature experimental matrix data. Analysis of our calculated spectroscopic results show that: (1) The excellent agreement between the ab initio CC-VSCF calculated frequencies and the experimental data suggest that the computed anharmonic potentials for N-methylacetamide are of a very high quality; (2) For most transitions, the vibrational frequencies obtained from the ab initio CC-VSCF method are superior to those obtained using the empirical CC-VSCF methods, when compared with experimental data. However, the improved empirical force field yields better agreement with the experimental frequencies as compared with a standard AMBER-type force field; (3) The empirical force field in particular overestimates anharmonic couplings for the amide-2 mode, the methyl asymmetric bending modes, the out-of-plane methyl bending modes, and the methyl distortions; (4) Disagreement between the ab initio and empirical anharmonic couplings is greater than the disagreement between the frequencies, and thus the anharmonic part of the empirical potential seems to be less accurate than the harmonic contribution; and (5) Both the empirical and ab initio CC-VSCF calculations predict a negligible anharmonic coupling between the amide-1 and other internal modes. The implication of this is that the intramolecular energy flow between the amide-1 and the other internal modes may be smaller than anticipated. These results may have important implications for the anharmonic force fields of peptides, for which N-methylacetamide is a model.

Author

*Coupled Modes; Vibrational States; Self Consistent Fields; Field Theory (Physics)*

20020039633 NASA Ames Research Center, Moffett Field, CA USA

**Absolute Rovibrational Intensities, Self-Broadening and Self-Shift Coefficients for the  $X(\nu_1) \Sigma^+ \nu_3$  (left arrow)  $\nu=0$  Band (C-12)(O-16)**

Chackerian, Charles, Jr., Search for Extraterrestrial Intelligence Inst., USA; Freedman, R., NASA Ames Research Center, USA; Giver, L. P., NASA Ames Research Center, USA; Brown, L. R., Jet Propulsion Lab., California Inst. of Tech., USA; [2001]; 28p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The rotationless transition moment squared for the  $x(\nu_1) \sigma(\nu_+) \nu=3$  (left arrow)  $\nu=0$  band of CO is measured to be the absolute value of  $R(\nu_3-0)$  squared =  $1.7127(25) \times 10(\exp -7)$  Debye squared. This value is about 8.6 percent smaller than the value assumed for HITRAN 2000. The Herman-Wallis intensity factor of this band is  $F=1+0.01168(11)m+0.0001065(79)m$  squared. The determination of self-broadening coefficients is improved with the inclusion of line narrowing; self-shifts are also reported.

Author

*Coefficients; Carbon Monoxide; Pressure Broadening; Rotation; Spectral Bands; Vibration*

20020040896 NASA Ames Research Center, Moffett Field, CA USA

**Ab Initio Calculation of Accurate Vibrational Frequencies for Molecules of Interest in Atmospheric Chemistry**

Lee, Timothy J., NASA Ames Research Center, USA; [1996]; 1p; In English, 25 Nov. 1996, AZ, USA

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

Due to advances in quantum mechanical methods over the last few years, it is now possible to determine ab initio potential energy surfaces in which fundamental vibrational frequencies are accurate to within  $\pm 8$  cm<sup>-1</sup> on average, and molecular bond distances are accurate to within  $\pm 0.001$ - $0.003$  Å, depending on the nature of the bond. That is, the potential energy surfaces have not been scaled or empirically adjusted in any way, showing that theoretical methods have progressed to the point of being useful in analyzing spectra that are not from a tightly controlled laboratory environment, such as rovibrational spectra from the interstellar medium. Some recent examples demonstrating this accuracy will be presented and discussed. These include the HNO, CH<sub>4</sub>, C<sub>2</sub>H<sub>4</sub>, and ClCN molecules. The HNO molecule is interesting due to the very large H-N anharmonicity, while ClCN has

a very large Fermi resonance. The ab initio studies for the CH<sub>4</sub> and C<sub>2</sub>H<sub>4</sub> molecules present the first accurate full quartic force fields of any kind (i.e., whether theoretical or empirical) for a five-atom and six-atom system, respectively.

Author

*Atmospheric Chemistry; Molecules; Vibrational Spectra; Chemical Bonds*

**20020040897** NASA Ames Research Center, Moffett Field, CA USA

**Low-Energy Electron Impact Excitation of the (010) Bending Mode of CO<sub>2</sub>**

Huo, Winifred M., NASA Ames Research Center, USA; [1996]; 1p; In English; 49th Gaseous Electronics Conference, 20-24 Oct. 1996, Argonne, IL, USA

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

Low-energy electron impact excitation of the fundamental modes of CO<sub>2</sub> has been extensively studied, both experimentally and theoretically. Much attention has been paid to the virtual state feature in the the (100) mode excitation and the (sup 2)II(sub upslon) resonance feature around 3.8 eV, which is observable in all three fundamental modes. For the excitation of the (010) mode away from the resonance region, the Born dipole approximation was generally considered adequate. The present study employs the Born dipole approximation to treat the long range interaction and the Schwinger multichannel method for the short range interaction. The roles of the two interaction potentials will be compared.

Author

*Electron Impact; Atomic Excitations; Carbon Dioxide; Bending*

**20020040898** NASA Ames Research Center, Moffett Field, CA USA

**The Calculation of Accurate Harmonic Frequencies of Large Molecules: The Polycyclic Aromatic Hydrocarbons, a Case Study**

Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; Langhoff, Stephen R., NASA Ames Research Center, USA; [1996]; 1p; In English

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

The vibrational frequencies and infrared intensities of naphthalene neutral and cation are studied at the self-consistent-field (SCF), second-order Moller-Plesset (MP2), and density functional theory (DFT) levels using a variety of one-particle basis sets. Very accurate frequencies can be obtained at the DFT level in conjunction with large basis sets if they are scaled with two factors, one for the C-H stretches and a second for all other modes. We also find remarkably good agreement at the B3LYP/4-31G level using only one scale factor. Unlike the neutral PAHs where all methods do reasonably well for the intensities, only the DFT results are accurate for the PAH cations. The failure of the SCF and MP2 methods is caused by symmetry breaking and an inability to describe charge delocalization. We present several interesting cases of symmetry breaking in this study. An assessment is made as to whether an ensemble of PAH neutrals or cations could account for the unidentified infrared bands observed in many astronomical sources.

Author

*Vibrational Spectra; Polycyclic Aromatic Hydrocarbons; Naphthalene; Infrared Radiation; Cations*

## 73

### NUCLEAR PHYSICS

*Includes nuclear particles; and reactor theory. For space radiation see 93 Space Radiation. For atomic and molecular physics see 72 Atomic and Molecular Physics. For elementary particle physics see 77 Physics of Elementary Particles and Fields. For nuclear astrophysics see 90 Astrophysics.*

**20020039712** New Mexico Resonance, Albuquerque, NM USA

**A Robust Magnetic Resonance Imager For Ground and Flight Based Measurements of Fluid Physics Phenomena *Final Report***

[2002]; 44p; In English

Contract(s)/Grant(s): NCC3-598; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nuclear magnetic resonance (NMR) is a powerful and versatile, noninvasive method for studying fluid transport problems. However, its applications to these types of investigations have been limited. A primary factor that limits the application of NMR has been the lack of a user-friendly, versatile, and inexpensive NMR imaging apparatus that can be used by scientists who are not familiar with sophisticated NMR. to rectify this situation, we developed a user-friendly, NMR imager for projects of relevance to the MRD science community. to that end, we performed preliminary collaborative experiments between NASA, NCMR, and

New Mexico Resonance in the high field NMR set up at New Mexico Resonance to track wetting front dynamics in foams under gravity. The experiments were done in a 30 cm, 1.9T Oxford magnet with a TECMAG Libra spectrometer (Tecmag, Inc., Houston, TX). We used two different imaging strategies depending on whether the water in the foam sample was static or moving. Stationary water distributions were imaged with the standard Fourier imaging method, as used in medical MRI, in which data are acquired from all parts of the region of interest at all times and Fourier transformed into a static spatial image.

Derived from text

*Nuclear Magnetic Resonance; Imaging Techniques; In-Flight Monitoring; Gravitation*

**20020040771** Oak Ridge National Lab., TN USA

**Decay of Resonance in (sup 18)Ne by the Simultaneous Emission of Two Protons**

Gomez del Campo, J.; Nov. 07, 2001; 6p; In English

Report No.(s): DE2002-789974; P01-112219; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Radioactive ion beams of F-17 were used to study several resonance states in Ne-18. Clear evidence for simultaneous two-proton emission from the 6.15 MeV state ( $J^{\pi} = 1^{+}$ ) in Ne-18 has been observed with the reaction F-17 + H. Because of limited angular coverage, the data did not differentiate between the two possible mechanisms of simultaneous decay, di-proton He-2 emission or direct three-body decay. The two-proton partial width was found to be 21 (+/-) 3 eV assuming He-2 emission and 57 (+/-) 6 eV assuming three-body decay. The total width of the 1 state was measured to be 50 (+/-) 5 keV. Several additional resonances that decay by single proton emission were also studied.

NTIS

*Neon Isotopes; Protons; Radioactive Decay; Emission; Proton Resonance*

**20020040776** Oak Ridge National Lab., TN USA

**Comparison of Sensitivity Analysis Techniques in Monte Carlo Codes for Multi-Region Criticality Calculations**

Rearden, B. T., Oak Ridge National Lab., USA; Jun. 29, 2001; 5p; In English

Report No.(s): DE2002-788723; P01-111199; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recently, sensitivity and uncertainty (S/U) techniques have been used to determine the area of applicability (AOA) of critical experiments used for code and data validation. These techniques require the computation of energy-dependent sensitivity coefficients for multiple reaction types for every nuclide in each system included in the validation. The sensitivity coefficients, as used for this application, predict the relative change in the system multiplication factor due to a relative change in a given cross-section data component or material number density. Thus, a sensitivity coefficient,  $S$ , for some macroscopic cross section, ( $\Sigma$ ), is expressed as  $S = (\Sigma/k) / (\partial \Sigma / \partial \text{parameter})$ , where  $k$  is the effective neutron multiplication factor for the system. The sensitivity coefficient for the density of a material is equivalent to that of the total macroscopic cross section. Two distinct techniques have been employed in Monte Carlo radiation transport codes for the computation of sensitivity coefficients. The first, and most commonly employed, is the differential sampling technique. The second is the adjoint-based perturbation theory approach. This paper briefly describes each technique and presents the results of a simple test case, pointing out discrepancies in the computed results and proposing a remedy to these discrepancies.

NTIS

*Sensitivity Analysis; Monte Carlo Method; Critical Experiments; Radioactive Isotopes*

**20020040837** Texas A&M Univ., College Station, TX USA

**Innovative reactor analysis methodology based on a quasidiffusion nodal core model. Topical report: Phase I for period August 15, 1999--August 14, 2000**

Anistratov, D. Y.; Adams, M. L.; Palmer, T. S.; Smith, K. S.; Sep. 19, 2000; 13p; In English

Report No.(s): DE2002-765720; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is a topical report of the NERI project "An Innovative Reactor Analysis Methodology Based on a Quasidiffusion Nodal Core Model."

NTIS

*Reactor Physics; Diffusion*

*Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.*

**20020039148** NASA Ames Research Center, Moffett Field, CA USA

**The Importance of Optical Pathlength Control for Plasma Absorption Measurements**

Cruden, Brett A., Eloret Corp., USA; Rao, M. V. V. S., Eloret Corp., USA; Sharma, Surendra P., NASA Ames Research Center, USA; Meyyappan, M., NASA Ames Research Center, USA; [2001]; 17p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An inductively coupled GEC Cell with modified viewing ports has been used to measure in-situ absorption in CF<sub>4</sub> plasmas via Fourier Transform Infrared Spectroscopy, and the results compared to those obtained in a standard viewport configuration. The viewing ports were modified so that the window boundary is inside, rather than outside, of the GEC cell. Because the absorption obtained is a spatially integrated absorption, measurements made represent an averaging of absorbing species inside and outside of the plasma. This modification is made to reduce this spatial averaging and thus allow a more accurate estimation of neutral species concentrations and temperatures within the plasmas. by reducing this pathlength, we find that the apparent CF<sub>4</sub> consumption increases from 65% to 95% and the apparent vibrational temperature of CF<sub>4</sub> rises by 50-75 K. The apparent fraction of etch product SiF<sub>4</sub> decreases from 4% to 2%. The data suggests that these density changes may be due to significant temperature gradients between the plasma and chamber viewports.

Author

*Plasmas (Physics); Optical Control; Absorption Spectroscopy; Infrared Spectra*

**20020039421** NASA Ames Research Center, Moffett Field, CA USA

**Absorbing Boundary Conditions For Optical Pulses In Dispersive, Nonlinear Materials**

Goorjian, Peter M., NASA Ames Research Center, USA; [1995]; 1p; In English; Optical Society of America Annual Meeting, 10-15 Sep. 1995, Portland, OR, USA

Contract(s)/Grant(s): RTOP 505-59-00; No Copyright; Avail: Issuing Activity; Abstract Only

This paper will present results in computational nonlinear optics. An algorithm will be described that provides absorbing boundary conditions for optical pulses in dispersive, nonlinear materials. A new numerical absorber at the boundaries has been developed that is responsive to the spectral content of the pulse. Also, results will be shown of calculations of 2-D electromagnetic nonlinear waves computed by directly integrating in time the nonlinear vector Maxwell's equations. The results will include simulations of "light bullet" like pulses. Here diffraction and dispersion will be counteracted by nonlinear effects. Comparisons will be shown of calculations that use the standard boundary conditions and the new ones.

Author

*Boundary Conditions; Dispersing; Diffraction; Nonlinear Optics; Electromagnetic Pulses; Algorithms*

**20020039639** NASA Ames Research Center, Moffett Field, CA USA

**Detector Arrays for an Airborne Infrared Echelle Spectrometer**

Erickson, E. F., NASA Ames Research Center, USA; Haas, M. R., NASA Ames Research Center, USA; Baltz, J. A., NASA Ames Research Center, USA; McKelvey, M. E., NASA Ames Research Center, USA; Colgan, S. W. J., NASA Ames Research Center, USA; Lynch, D. H., NASA Ames Research Center, USA; Wolf, J., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; [1996]; 1p; In English; Noordwijk ESLAB Meeting, 24-26 Sep. 1996, Noordwijk, Netherlands; Sponsored by Electronic Service Lab. s.r.l., Unknown

Contract(s)/Grant(s): RTOP 263-10-01; No Copyright; Avail: Issuing Activity; Abstract Only

The design of a long-slit echelle spectrograph covering the 16 - 210 micron range for use on the Stratospheric Observatory for Infrared Astronomy (SOFIA) is under study at NASA-Ames. This wavelength range is selected for its content of important astrophysical spectral lines accessible from an airborne platform, and availability of suitable detectors. Two dimensional arrays will be used to simultaneously provide spectral coverage in the dispersion direction and imaging in the cross-dispersion direction. Major goals are: (1) to reach sensitivities limited primarily by the background from the residual atmosphere and the telescope; (2) to provide imaging not far from the diffraction limit of the 2.5 meter (effective) aperture of the telescope; and (3) to obtain diffraction-limited spectral resolution from the large echelle grating, which means that the resolving power increases with decreasing wavelength. to meet these requirements, three detector types are foreseen: a commercially available monolithic Si:Sb IBC array to cover the wavelength range from 16 to 40 microns, a Ge:Sb photoconductor array to cover the range from 40 to 125

microns, and a stressed Ge:Ga photoconductor array covering the range from 125 to 210 microns. The paper discusses details of the studies and plans for the field optics, detectors, and readouts.

Author

*Echelle Gratings; Spectrographs; Airborne Equipment*

**20020039849** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Subsystem Imaging Performance and Modeling of the Infrared Multi-Object Spectrograph**

Connelly, Joseph A., NASA Goddard Space Flight Center, USA; Tveekrem, June L., NASA Goddard Space Flight Center, USA; Ohl, Raymond G., NASA Goddard Space Flight Center, USA; Mink, Ronald, NASA Goddard Space Flight Center, USA; Chambers, V. John, NASA Goddard Space Flight Center, USA; Mentzell, J. Eric, NASA Goddard Space Flight Center, USA; Greenhouse, Matthew A., NASA Goddard Space Flight Center, USA; MacKenty, John W., Space Telescope Science Inst., USA; [2002]; 3p; In English; SPIE Conference, 22-28 Aug. 2002, Kona, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Infrared Multi-Object Spectrograph (IRMOS) is a facility instrument for the Kitt Peak National Observatory Mayall Telescope (3.8 meter). IRMOS is a near-IR (0.8 - 2.5 micron) spectrograph with low to mid resolution ( $R = \lambda/\Delta\lambda$ ,  $\lambda = 300 - 3800$ ). The IRMOS spectrograph produces simultaneous spectra of ~ 100 objects in its 2.8 x 2.0 arc-min field of view using a commercial MEMS multi-mirror array device (MMA). The IRMOS optical design consists of two imaging systems, or "stages." The focal reducer, stage one, images the focal plane of the telescope onto the MMA. The spectrograph, stage two, images the MMA onto the detector. We describe the breadboard alignment method and imaging and scattered light performance for both the focal reducer and spectrograph. This testing provides verification of the optomechanical alignment method, and a measurement of the contribution of scattered light in the system due to mirror small scale surface error. After the stage 1 and 2 optics are integrated with the instrument, our test results will make it possible to distinguish between scattered light from the mirrors and the MMA. Image testing will be done at four wavelengths in the visible and near-IR. A mercury-argon pencil lamp will provide spectral lines at 546.1 and 1012 nm, and a blackbody radiation source lines at 1600 and 2200 nm. A CCD camera will be used as a detector for the visible wavelengths, and an IR photodiode will be used for the IR wavelengths. We compare our data with a theoretical analysis using a commercial software package. Mirror surface error is modeled by treating each surface as a superposition of various gratings (e.g., diamond turning tool marks, features due to the impurities of Al 6061, and periodic mid-frequency errors due to drift during machining).

Author

*Applications Programs (Computers); Breadboard Models; Design Analysis; Spectrographs; CCD Cameras; Infrared Spectra*

**20020040110** Air Force Research Lab., Kirkland AFB, NM USA

**Radiation Effects in Quantum Well Detectors *Final Report, 1 Oct. 1997-30 Sep. 1999***

Manasreh, Omar; Oct. 2001; 24p; In English

Contract(s)/Grant(s): AF Proj. 2305

Report No.(s): AD-A399285; AFRL-VS-TR-2001-1112; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We performed photoluminescence (PL) measurements of interband transitions in InGaAs/ AlGaAs multiple quantum wells before and after fast neutron irradiation. It is shown that the intensity of the intersubband transitions is dramatically decreased in heavily irradiated samples, which can be explained in terms of trapping of the two-dimensional electrons by the irradiation induced defects. A negative persistent effect was also observed in the heavily irradiated samples. It is noted that the recovery of the electrons from this effect occurs at two temperature stages with thresholds at approx. 104K and approx. 250K, which indicates that the electrons were released from two different traps as the temperature is increased. We also investigated the effects of 1 MeV proton beam with doses ranging between  $10 \times 10^{12}$  and  $5.0 \times 10^{14}$ /sq cm on GaAs/ AlGaAs. It is observed that the total integrated area of the intersubband transitions are dramatically decreased as the irradiation dose is increased. This reduction was interpreted as being due to the trapping of the two-dimensional electron gas by the irradiation-induced-defects. The total integrated areas of the intersubband transitions were studied as a function of irradiation doses for samples cut from wafers with structures containing either bulk or superlattice barriers. The results reveal that the intersubband transitions in samples with superlattice barriers degrade at a faster rate as compared to those transitions in samples with bulk barriers.

DTIC

*Photoluminescence; Radiation Effects; Quantum Wells; Energy Bands*

**20020040334** Surface Optics Corp., San Diego, CA USA

**A Comparison of BRDF Representations and their Effect on Signatures**

Jafolla, James, Surface Optics Corp., USA; Thomas, David, Army Tank-Automotive and Armaments Command, USA; Hilgers, John, Signature Research, Inc., USA; Oct. 1998; 17p; In English; Original contains color images; See Also ADM201041. IRIS Proceedings (1998) on CD-ROM. --Original contains color plates: All DTIC reproductions will be in black and white. Prepared in cooperation with Signature Research, Inc. Calumet, MI; US Tank-Automotive and Armaments Command Report No.(s): AD-A399506; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The application of advanced low observable treatments to ground vehicles has led to a requirement for a better understanding of effects of light scattering from surfaces. Measurements of the Bidirectional Reflectance Distribution Function (BRDF) fully describe the angular scattering properties of materials, and these may be used in signature simulations to accurately characterize the optical effects of surface treatments on targets. This paper examines some of the popular parameterized BRDF representations and shows their effect on signature calculations.

DTIC

*Bidirectional Reflectance; Distribution Functions; Light Scattering; Infrared Signatures; Target Recognition*

**20020040876** NASA Ames Research Center, Moffett Field, CA USA

**Parafoveal Target Detectability Reversal Predicted by Local Luminance and Contrast Gain Control**

Ahumada, Albert J., Jr., NASA Ames Research Center, USA; Beard, Bettina L., California Univ., USA; [1996]; 1p; In English; 1997 Annual Meeting of the Association for Research in Vision and Ophthalmology, 11-16 May 1997, Fort Lauderdale, FL, USA; Sponsored by Association for Research in Vision and Ophthalmology, USA

Contract(s)/Grant(s): RTOP 505-64-53; RTOP 199-06-12-31; No Copyright; Avail: Issuing Activity; Abstract Only

This project is part of a program to develop image discrimination models for the prediction of the detectability of objects in a range of backgrounds. We wanted to see if the models could predict parafoveal object detection as well as they predict detection in foveal vision. We also wanted to make our simplified models more general by local computation of luminance and contrast gain control. A signal image (0.78 x 0.17 deg) was made by subtracting a simulated airport runway scene background image (2.7 deg square) from the same scene containing an obstructing aircraft. Signal visibility contrast thresholds were measured in a fully crossed factorial design with three factors: eccentricity (0 deg or 4 deg), background (uniform or runway scene background), and fixed-pattern white noise contrast (0%, 5%, or 10%). Three experienced observers responded to three repetitions of 60 2IFC trials in each condition and thresholds were estimated by maximum likelihood probit analysis. In the fovea the average detection contrast threshold was 4 dB lower for the runway background than for the uniform background, but in the parafovea, the average threshold was 6 dB higher for the runway background than for the uniform background. This interaction was similar across the different noise levels and for all three observers. A likely reason for the runway background giving a lower threshold in the fovea is the low luminance near the signal in that scene. In our model, the local luminance computation is controlled by a spatial spread parameter. When this parameter and a corresponding parameter for the spatial spread of contrast gain were increased for the parafoveal predictions, the model predicts the interaction of background with eccentricity.

Author

*Computer Vision; Fovea; Luminance; Target Recognition; Detection; Pattern Recognition*

## 75

### PLASMA PHYSICS

*Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.*

**20020039302** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

**Plasma Waves Observed During CUSP Energetic Particle Events and Their Correlation With Polar and Akebono Satellite and Ground Data**

Pickett, J. S., Iowa Univ., USA; Gurnett, D. A., Iowa Univ., USA; Menietti, J. D., Iowa Univ., USA; LeDocq, M. J., Iowa Univ., USA; Scudder, J. D., Iowa Univ., USA; Frank, L. A., Iowa Univ., USA; Sigwarth, J. B., Iowa Univ., USA; Ackerson, K. L., Iowa Univ., USA; Morgan, D. D., Iowa Univ., USA; Franz, J. R., Cornell Univ., USA; Advances in Space Research; 1999; ISSN 0273-1177; Volume 24, No. 1, pp. 23-33; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-30371; Copyright; Avail: Issuing Activity

We present Polar plasma wave data during cusp energetic particle (CEP) events at 6-9 R(sub E). These data suggest the presence of coherent electrostatic structures that are highly localized and that have typical velocities on the order of hundreds to

thousands of kilometers per second along the ambient magnetic field. Some of the wave signatures are solitary waves and some are wave packets. The Polar wave instrument also provides evidence that some of the bursts of electromagnetic waves (with frequencies of a few hundred Hz and just below the electron cyclotron frequency around 800 Hz to 1-2 kHz) that are observed are coherent and propagating both up and down the field lines. Electron cyclotron harmonic (ECH) waves are often detected but their duration is usually short (less than 1 second). Low Frequency (less than 1 kHz), broadband, bursty electromagnetic waves are also present. The Polar wave data results are used to obtain a better understanding of the macro/microphysics during a CEP event that takes place on September 11, 1996, by correlating various Polar (approximately 7.0  $R_{\text{sub E}}$ ) and Akebono (approximately 1.4  $R_{\text{sub E}}$ ) data while both spacecraft are in or near the cusp/cleft region and nearly on the same field line, and magnetometer data from the Canadian Intermagnet and Canopus ground stations, which lie near the base of the magnetic footprint passing through Polar. Solar wind and magnetic field data from the interplanetary medium and magnetosheath are provided by the Geotail and IMP-8 satellites, respectively. Some of the cusp waves may be indicators of the reconnection process taking place through the cusp, the result of mixing of magnetosheath with magnetospheric plasma, and the consequence of an anisotropic electron population in a depressed magnetic field. The low frequency electromagnetic waves are still under study to determine their role, if any, in the heating and acceleration of the MeV He ions during CEP events.

Author

*Plasma Waves; Energetic Particles; Exos-D Satellite; Correlation; Polar Cusps; Electromagnetic Radiation; Electrostatics; Data Acquisition*

## 76

### SOLID-STATE PHYSICS

*Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.*

**20020039643** NASA Ames Research Center, Moffett Field, CA USA

#### **The Dissociation Energies of CH<sub>4</sub> and C<sub>2</sub>H<sub>2</sub> Revisited**

Partridge, Harry, NASA Ames Research Center, USA; Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; [1995]; 1p; In English

Contract(s)/Grant(s): RTOP 232-01-04; No Copyright; Avail: Issuing Activity; Abstract Only

The bond dissociation energies of CH<sub>4</sub> and C<sub>2</sub>H<sub>2</sub> and their fragments are investigated using basis set extrapolations and high levels of correlation. The computed bond dissociation energies ( $D_{\text{sub e}}$ ) are accurate to within 0.2 kcal/mol. The agreement with the experimental ( $D_{\text{sub 0}}$ ) values is excellent if we assume that the zero-point energy of C<sub>2</sub>H is 9.18 kcal/mol. The effect of core (1s) correlation on the bond dissociation energies of C-H bonds is shown to vary from 0.2 to 0.7 kcal/mol and that for C-C bonds varies from 0.4 to 2.2 kcal/mol.

Author

*Bonding; Acetylene; Methane; Extrapolation; Dissociation; Zero Point Energy*

**20020039690** Ljubljana Univ., Lab. of Metrology and Quality, Ljubljana, Slovenia

#### **Evaluation of Measurement Uncertainty in Testing Laboratories** *Ovrednotenje Merilne Negotovosti v Preskusnih Laboratorijih*

Beges, Gaber, Ljubljana Univ., Slovenia; Drnovsek, Janko, Ljubljana Univ., Slovenia; Pusnik, Igor, Ljubljana Univ., Slovenia; Bojkovski, Jovan, Ljubljana Univ., Slovenia; Electrotechnical Review; 2001; ISSN 0013-5852; Volume 68, No. 5, pp. 286-293; In English; Copyright; Avail: Issuing Activity

The objective of the paper is to elaborate new elements related to metrological analyses in the field of testing, such as measurement uncertainty and traceability. Until now the international standard ISO 45001 did not explicitly required uncertainty specifications in the area of testing in the same extent as the newly implemented standard ISO/IEC 17025. Therefore several additional steps should be taken in specifying the measurement and testing results especially those concerning performance of testing and other conformity assessment activities. The following contribution is focused on uncertainty analyses of a test procedure regarding electrical safety of household appliances developed according to the European standard EN 60335-1. The example serves as a useful case study, as well as a very illustrative example, highlighting many dilemmas. This particular case is relatively straightforwardly to evaluated due to the relative ease of traceability of its electrical and thermal quantities.

Author

*Metrology; Electrical Engineering; Maintenance; Heating Equipment*

**20020039706** Norfolk State Univ., VA USA

**Development of Solid State Laser Materials for Application in Lasers for Atmospheric Ozone and Water Vapor Sensing**  
**Final Report, 1 Jan. 2000 - 31 Dec. 2001**

Noginov, Makhail A., Norfolk State Univ., USA; Loutts, G. B., Norfolk State Univ., USA; Mar. 14, 2002; 59p; In English  
Contract(s)/Grant(s): NAG1-2172; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We have grown neodymium doped mixed apatite crystals,  $(\text{Sr}(x)\text{Ba}(1-x))_5(\text{PO}_4)_3\text{F}$ ,  $\text{Sr}_5(\text{P}(1-x)\text{V}(x)\text{O}_4)_3\text{F}$ , and  $\text{Ba}_5(\text{P}(1-x)\text{V}(x)\text{O}_4)_3\text{F}$ , and spectroscopically studied them as potential gain media for a laser source for atmospheric water sensing operating at 944.11 nm. We conclude that an appropriate apatite host material for a 944.11 nm laser should be a mixture of  $\text{Sr}_5(\text{PO}_4)_3\text{F}$  with a small fraction of  $\text{Ba}_5(\text{PO}_4)_3\text{F}$ . The precise wavelength tuning around 944.11 nm can be accomplished by varying the host composition, temperature, and threshold population inversion. In apatite crystals of mixed composition, the Amplified Spontaneous Emission (ASE) loss at 1.06 microns is predicted to be significantly smaller than that in the end members.

Author

*Solid State Lasers; Semiconductors (Materials); Laser Materials; Doped Crystals; Calcium Phosphates*

**20020039784** Thermoscience Inst., Moffett Field, CA USA

**The Role of Conical Intersections in Electronic Quenching of a State OH by H<sub>2</sub> and N<sub>2</sub>**

Walch, Stephen P., Thermoscience Inst., USA; [1997]; 1p; In English; Winter Gordon Conference on Molecular Energy Transfer, 5-10 Jan. 1997, Ventura, CA, USA; Sponsored by Gordon Research Conferences, Inc., USA

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

Lester and coworkers have experimentally characterized complexes of OH in the X and A states with H<sub>2</sub> and N<sub>2</sub>. Recently, we have carried out ab initio calculations of relevant portions of the ground state and excited state potential energy surfaces for these systems, including the conical intersection regions, which are responsible for electronic quenching of the A state of OH by H<sub>2</sub> and N<sub>2</sub>. Both of these systems have weakly bound complexes in the X state and strongly bound complexes in the A state. The OH-H<sub>2</sub> complex is T-shaped, while the OH-N<sub>2</sub> complex is collinear. In both cases the H end of OH is oriented toward the H<sub>2</sub> or N<sub>2</sub> molecule, respectively. Rotation of the OH about its center of mass involves only a small barrier and rotation by 180° so that the O end of OH is oriented toward the H<sub>2</sub> or N<sub>2</sub> molecule leads to conical intersections with the ground state surface. Since there is about 95 kcal/mol of available energy after crossing to the ground state surface, chemical reactions on the ground state surface are possible, in addition to electronic quenching. In the case of OH-H<sub>2</sub>, the conical intersection is much lower in energy than the OH (A state) + H<sub>2</sub> asymptotic energy and the A state complex can be characterized as a hanging well on the upper cone of the conical intersection. Passage through the conical intersection places the system on the ground state potential energy surface with the possibility of going to OH (X state) + H<sub>2</sub> (i.e. electronic quenching) or to H<sub>2</sub>O + H (reaction). For OH-N<sub>2</sub>, the A state complex is also a hanging well on the upper cone of the conical intersection, but the conical intersection is only slightly below the OH (A state) + H<sub>2</sub> asymptotic energy. Passage through the conical intersection can lead to OH (X state) + N<sub>2</sub> (i.e. electronic quenching), but so far reactive pathways have not been found.

Author

*Hydrogen; Molecular Structure; Nitrogen; Hydroxides; Molecular Energy Levels; Quenching (Atomic Physics)*

**20020039800** MRJ, Inc., Moffett Field, CA USA

**Molecular Dynamics Simulation of a Multi-Walled Carbon Nanotube Based Gear**

Han, Jie, MRJ, Inc., USA; Globus, Al, MRJ, Inc., USA; Srivastava, Deepak, MRJ, Inc., USA; [1997]; 2p; In English; Electrochemical Society's 191st Meeting, 4-9 May 1997, Montreal, Quebec, Canada; Sponsored by Electrochemical Society, Inc., USA

Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

We used molecular dynamics to investigate the properties of a multi-walled carbon nanotube based gear. Previous work computationally suggested that molecular gears fashioned from (14,0) single-walled carbon nanotubes operate well at 50-100 gigahertz. The gears were formed from nanotubes with teeth added via a benzyne reaction known to occur with C<sub>60</sub>. A modified, parallelized version of Brenner's potential was used to model interatomic forces within each molecule. A Leonard-Jones 6-12 potential was used for forces between molecules. The gear in this study was based on the smallest multi-walled nanotube supported by some experimental evidence. Each gear was a (52,0) nanotube surrounding a (37,10) nanotube with approximate 20.4 and 16.8 Å radii respectively. These sizes were chosen to be consistent with inter-tube spacing observed by and were slightly larger than graphite inter-layer spacings. The benzyne teeth were attached via 2+4 cycloaddition to exterior of the (52,0) tube. 2+4 bonds were used rather than the 2+2 bonds observed by Hoke since 2+4 bonds are preferred by naphthalene and quantum calculations by Jaffe suggest that 2+4 bonds are preferred on carbon nanotubes of sufficient diameter. One gear was 'powered' by forcing the atoms near the end of the outside buckytube to rotate to simulate a motor. A second gear was allowed to rotate by keeping the atoms near

the end of its outside buckytube on a cylinder. The ends of both gears were constrained to stay in an approximately constant position relative to each other, simulating a casing, to insure that the gear teeth meshed. The stiff meshing aromatic gear teeth transferred angular momentum from the powered gear to the driven gear. The simulation was performed in a vacuum and with a software thermostat. Preliminary results suggest that the powered gear had trouble turning the driven gear without slip. The larger radius and greater mass of these gears relative to the (14,0) gears previously studied requires a smaller rotation rate and multiple rows of teeth to avoid excessive force on the gear teeth resulting, in slip and failure of the driven gear to turn. We hope that studies such as these will eventually lead to synthesis of components that can be assembled into atomically precise fullerene machines. These machines, in turn, may someday be used in machine-phase fullerene materials with remarkable properties.

Author

*Carbon Nanotubes; Gears; Molecular Dynamics; Nanotechnology*

**20020040770** Oak Ridge National Lab., TN USA

**Optical Spectroscopy of the Structural Phase Transition of VO(sub 2) Nanocrystals in Optical Fibers and Thin Films**

Lopez, R.; Dec. 04, 2001; 2p; In English

Report No.(s): DE2002-789971; P01-112539; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The optical spectroscopy of VO(sub 2) nanocrystals in planar and fiber-waveguide geometries shows a size-and doping-dependent structural semiconductor-to-metal phase transition and a shape-dependent surface plasmon resonance, with unusual linear and nonlinear applications possibilities.

NTIS

*Nanocrystals; Optical Fibers; Thin Films; Vanadium Oxides; Phase Transformations; Optical Emission Spectroscopy; Semiconductors (Materials)*

**20020040783** Oak Ridge National Lab., TN USA

**Egress Shielding Studies for the SNS Accelerator System**

Bucholz, J. A.; Aug. 21, 2001; 9p; In English

Report No.(s): DE2002-788689; P01-111662; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The radiation transport and dose levels at four egresses located in the Spallation Neutron Source (SNS) accelerator system were analyzed based on controlled and uncontrolled beam losses in the accelerator system. A six-step hybrid Monte Carlo/Discrete Ordinates approach was employed to solve these problems using the Monte Carlo code MCNPX and the discrete ordinates code DORT along with the coupling tools MTD and DTD. MCNPX served to characterize the generation and leakage of secondary radiation from the accelerator and beam line structures, whereas DORT performed the analyses of the radiation fields (neutrons and gammas) in the accelerator tunnels and walkways of the egress. The coupling tools facilitated generation of the boundary sources from one transport step to the next step. In this effort, large detailed accelerator models were built for MCNPX to properly describe the different types of linac structures, the beam transport and focusing elements (dipoles, quadrupoles, sextupoles), and the beam collimators. The studies confirmed that the present egress designs were adequate to attenuate the dose in the linac tunnel of up to 100 rem/hr to a level of about 0.5 mrem/hr at the egress exit during normal operation. The egress in the accumulator ring is located at the entrance of the collimator section, a section with a high beam loss rate. For this reason, a dose level in the tunnel of 400 rem/hr was estimated along with a dose level at the exit of the egress of (approx)3 mrem/hr, which makes it a limited occupancy radiation area.

NTIS

*Linear Accelerators; Dosage; Neutron Sources; Beams (Supports); Losses*

**20020040833** National Renewable Energy Lab., Golden, CO USA

**Alternative Solar-Grade Silicon Feedstock Approaches: Preprint**

Ciszek, T. F.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000029; NREL/CP-520-31007; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at the 2001 NCPV Program Review Meeting: Report on research on four alternative methods for purifying metallurgical-grade silicon to target levels suitable for solar-grade silicon.

NTIS

*Silicon; Purification; Conferences*

**20020040834** National Renewable Energy Lab., Golden, CO USA

**Atmospheric Pressure Iodine Vapor Transport for Thin-Silicon Growth: Preprint**

Wang, T. H.; Oct. 01, 2001; 4p; In English

Report No.(s): DE2002-15000028; NREL/CP-520-31006; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Presented at 2001 NCPV Program Review Meeting: Randomly oriented or(110) pc-Si layers grown on foreign and Si substrates by atmospheric pressure IVT with high rates and large grain sizes.

NTIS

*Silicon; Atmospheric Pressure; Vapors; Iodine*

**77**

**PHYSICS OF ELEMENTARY PARTICLES AND FIELDS**

*Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also 72 Atomic and Molecular Physics, 73 Nuclear Physics, and 25 Inorganic, Organic and Physical Chemistry.*

**20020040769** Oak Ridge National Lab., TN USA

**Support Facility for a Mercury Target Neutrino Factory**

Spampinato, P. T.; Dec. 06, 2001; 39p; In English

Report No.(s): DE2002-789970; ORNL/TM-2001/124; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A conceptual design for a neutrino-producing facility is presented, including the mercury-jet target system, beam absorber, and facility for the target/capture region. The mercury system is a closed loop that includes a containment structure in the high-magnetic field region, a mercury pool beam absorber, conventional equipment such as magnetic-coupled pumps, valves, a heat exchanger, and a special nozzle insert. The superconducting solenoids in the target region are protected from nuclear heating and radiation damage with water-cooled tungsten-carbide shielding; the decay channel solenoids are protected with water-cooled steel shielding. The target region and decay channel have high-neutron fluxes resulting in components that are highly activated. Therefore, the facility configuration is based on remotely maintaining the target system and the magnets, as well as providing sufficient shielding for personnel. Summaries of cost estimates for the target system, magnet shielding, maintenance equipment, and the facility are also presented.

NTIS

*Neutrinos; Mercury (Metal); Superconductivity; Targets; Solenoids*

**80**

**SOCIAL AND INFORMATION SCIENCES (GENERAL)**

*Includes general research topics related to sociology; educational programs and curricula.*

**20020039434** NASA Ames Research Center, Moffett Field, CA USA

**Bringing "Scientific Expeditions" Into the Schools**

Watson, Val, NASA Ames Research Center, USA; [1995]; 1p; In English; 3rd International Interactive Multimedia Symposium, 21-25 Jan. 1996, Perth, Australia

Contract(s)/Grant(s): RTOP 536-01-50; No Copyright; Avail: Issuing Activity; Abstract Only

Two new technologies, the FASTexpedition and Remote FAST, have been developed that provide remote, 3D, high resolution, dynamic, interactive viewing of scientific data (such as simulations or measurements of fluid dynamics). The FASTexpedition permits one to access scientific data from the World Wide Web, take guided expeditions through the data, and continue with self controlled expeditions through the data. Remote FAST permits collaborators at remote sites to simultaneously view an analysis of scientific data being controlled by one of the collaborators. Control can be transferred between sites. These technologies are now being used for remote collaboration in joint university, industry, and NASA projects in computational fluid dynamics (CFD) and wind tunnel testing. Also, NASA Ames Research Center has initiated a project to make scientific data and guided expeditions through the data available as FASTexpeditions on the World Wide Web for educational purposes. Previously, remote visualization of dynamic data was done using video format (transmitting pixel information) such as video conferencing or MPEG movies on the Internet. The concept for this new technology is to send the raw data (e.g., grids, vectors, and scalars) along with viewing scripts over the Internet and have the pixels generated by a visualization tool running on the viewer's local

workstation. The visualization tool that is currently used is FAST (Flow Analysis Software Toolkit). The advantages of this new technology over using video format are: 1. The visual is much higher in resolution (1280x1024 pixels with 24 bits of color) than typical video format transmitted over the network. 2. The form of the visualization can be controlled interactively (because the viewer is interactively controlling the visualization tool running on his workstation). 3. A rich variety of guided expeditions through the data can be included easily. 4. A capability is provided for other sites to see a visual analysis of one site as the analysis is interactively performed. Control of the analysis can be passed from site to site. 5. The scenes can be viewed in 3D using stereo vision. 6. The network bandwidth used for the visualization using this new technology is much smaller than when using video format. (The measured peak bandwidth used was 1 Kbit/sec whereas the measured bandwidth for a small video picture was 500 Kbits/sec.)

Author

*Video Communication; Software Development Tools; Computational Fluid Dynamics; Simulation; Viewing; NASA Programs*

## 81

### ADMINISTRATION AND MANAGEMENT

*Includes management planning and research.*

**20020039691** Ljubljana Univ., Fakulteta za Elektrotehniko, Ljubljana, Slovenia

**Riskless Modification of Job-Shop Schedules** *Netvegano Izvajanje Sprememb na Urnikih Tehnoloskih Procesov*

Murovec, Bostjan, Ljubljana Univ., Slovenia; Electrotechnical Review; 2001; ISSN 0013-5852; Volume 68, No. 5, pp. 313-318; In Slovene; Copyright; Avail: Issuing Activity

Many production scheduling problems are known to be NP-hard. Their complexity prevents us to obtain optimal solutions even for small-to middle-sized instances of the problems encountered in practice. Therefore, we are forced to use heuristic algorithms that do not guarantee optimality of delivered solutions, but their time and memory requirements are practically manageable. One of such approaches is the local search technique, which has become a widely used tool for solving many combinatorial optimization problems. It is basically an iterative approach where an arbitrary starting solution is optimized in steps by performing small modifications on it. In the case of the production scheduling problems, the implementation of such technique is not straightforward at all due to the existence of technological constraints among the predefined sets of operations. Their presence opens up the possibility of reaching infeasible solutions by executing certain modifications during optimization. Predicting infeasibility of a modification is a prohibitively time consuming process. Traditionally, the problem is dealt with in three different ways: (1) local search is permitted to execute only a limited set of modifications for which feasibility inherently holds, (2) a fast estimate of infeasibility is used by which presumably infeasible modifications are excluded from the search, (3) presumably infeasible modifications are changed in a certain way to preserve feasibility. These approaches have certain drawbacks: (1) too small set of modifications enters the optimization, which prevents aggressive searching of the solution space, (2) potentially feasible and improving modifications are discarded, (3) changed modifications are hard to exploit efficiently. This paper proposes an alternative way to avoid infeasibility by incorporating a repairing technique into the mechanism for applying modifications to a solution. The possibility of reaching an infeasible solution is eliminated on the fly by modifying it in such a way that the feasibility is always preserved. In that way, the local search algorithm is permitted to execute any desired modification.

Author

*Combinatorial Analysis; Optimization; Discrete Functions; Scheduling*

**20020039914** RAND Corp., Santa Monica, CA USA

**Developing Aerospace Leaders for the Twenty-First Century**

Weaver, Nancy; Apr. 2001; 77p; In English

Report No.(s): AD-A399190; RAND/P-8060; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Sound leadership within a dynamic, ever-changing environment is at the heart of the Air Force's institutional character. It is key to bonding airmen and is the foundation for successful Air Force achievements in peace and in war. Of the many skills and abilities used in the profession of arms, none is prized more highly. As we transform to meet the challenges of the twenty-first century, leadership can strengthen the foundation of mutual trust and respect among the ranks and the organization as a whole. Most people who equate leadership with good management model their leadership practices based on readings and research published in the industrial era of the twentieth century. This understanding of leadership has dominated military organizations in the past but will not serve the mature Expeditionary Aerospace Force of tomorrow. This paper explores the advantages to adapting emerging leadership philosophies into the Air Force culture to meet the growing challenges of the twenty-first century

work force. Leadership doctrine, leadership development programs, and the human resource management system should be aligned to support these changes in leadership philosophy and practice. This is critical in order to build Air Force leaders with a clearly recognizable set of competencies and attitudes that thrive regardless of a particular career-path or assigned location throughout an entire career.

DTIC

*Leadership; Aerospace Systems; Armed Forces (USA); Personnel Management*

**20020040839** Department of Energy, Washington, DC USA

**Small Business Innovation Research. Abstracts of Phase I awards, 1999**

Dec. 01, 1999; 138p

Report No.(s): DE2002-771001; DOE/SC-0023; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This booklet presents technical abstracts of Phase I awards made in Fiscal Year (FY) 1999 under the DOE Small Business Innovation Research (SBIR) program. SBIR research explores innovative concepts in important technological and scientific areas that can lead to valuable new technology and products. The work described in the abstracts is novel, high-risk research, but the benefits will also be potentially high if the objectives are met. Brief comments on the potential applications, as described by the awardee, are given after each abstract. Individuals and organizations, including venture capital and larger industrial firms, with an interest in the research described in any of the abstracts are encouraged to contact the appropriate small business directly.

NTIS

*Commerce; Abstracts; Research and Development*

**20020040892** Department of Energy, Washington, DC USA

**Small Business Innovation Research. Abstracts of Phase II awards, 2000**

Dec. 01, 2000; 78p

Report No.(s): DE2002-771002; DOE/SC-0029; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The SBIR program enables DOE to obtain effective, innovative solutions to important problems through the private sector, which has a commercial incentive to pursue the resulting technology and bring it to the marketplace. The growing number of awardees, many of them started in business in response to SBIR solicitations, is becoming a significant resource for the solution of high risk, high technology problems for the Department. As detailed below, this publication describes the technical efforts and commercialization possibilities for SBIR Phase II awards in Fiscal Year (FY) 2000. It is intended for the educated layman, and maybe of particular interest to potential investors who wish to get in on the ground floor of exciting opportunities.

NTIS

*Commerce; Abstracts; Research and Development*

## 82

### DOCUMENTATION AND INFORMATION SCIENCE

*Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.*

**20020039544** Research and Technology Organization, Neuilly-sur-Seine, France

**RTO Technical Publications: A Quarterly Listing *Quarterly Report, 1 Jan. - 31 Mar. 2002***

April 2002; 3p; In English

Report No.(s): RTO-02-01; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This is a listing of recent unclassified RTO technical publications processed by the NASA Center for AeroSpace Information. Reports may be downloaded for free from the RTO website at <http://www.rta.nato.int> or they may be purchased from the NASA Center for AeroSpace Information.

Author

*Documents; Reports*

**20020039631** Alabama Univ., Huntsville, AL USA

**Restoration, Enhancement, and Distribution of the ATLAS-1 Imaging Spectrometric Observatory (ISO) Space Science Data Set *Final Report, 15 Mar. 1999 - 14 Sep. 2001***

Germany, G. A., Alabama Univ., USA; [2001]; 4p; In English

Contract(s)/Grant(s): NAG5-8303; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The primary goal of the funded task was to restore and distribute the ISO ATLAS-1 space science data set with enhanced software and database utilities. The first year was primarily dedicated to physically transferring the data from its original format to its initial CD archival format. The remainder of the first year was devoted to the verification of the restored data set and database. The second year was devoted to the enhancement of the data set, especially the development of IDL utilities and redesign of the database and search interface as needed. This period was also devoted to distribution of the rescued data set, principally the creation and maintenance of a web interface to the data set. The final six months was dedicated to working with NSSDC to create a permanent, off site, hive of the data set and supporting utilities. This time was also used to resolve last minute quality and design issues.

Derived from text

*Imaging Techniques; Data Bases; Spectrometers*

**20020039703** NASA Ames Research Center, Moffett Field, CA USA

**NASA Virtual Conferences and Instruction Over the Internet**

Leon, Mark, NASA Ames Research Center, USA; McCurdy, Andrea, Sterling Software, Inc., USA; Wood, Charles, North Dakota Univ., USA; [1997]; 30p; In English; INET, 24 Jun. 1997, Malaysia

Contract(s)/Grant(s): RTOP 509-40-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Distance learning is not new. Since the time that radio has embellished our culture distance learning has taken on many forms. With the onset of television, video tape and satellite link ups the world of multimedia has taken a presence in our remote learning environment. Now in the information age new models for bring the best education to people through out the world is in its early stages. Recent "Information Age" technological developments have made key advancements to distance learning through the greater bandwidths now available over the Internet and a broader communications infrastructure that extends to classrooms throughout the country and the world. Further, new software compression technology allows audio and video to be communicated over the Internet much more efficiently. Larger amounts of data can be transferred to remote sites at less cost. The purpose of this paper is to demonstrate the use of state-of-art technology in the educational community. The focus will be on virtual conferences, virtual instruction and remote education. The techniques herein have been developed by NASA and the University of North Dakota(UND) through the use of existing software and hardware purchased in the United States. NASA has awarded UND a grant for continued research in this area based on their pioneering effort to date. NASA has been conducting "Virtual Conferences" from Ames Research Center in order to make unique educational opportunities available to participants across the country and internationally. Through the use of this technical approach, hundreds of teachers have been able to attend events where physical or financial barriers traditionally prevented their attendance. This technique is currently being adopted by industry due to its scaleable merit.

Derived from text

*Internets; Conferences; Software Engineering; Computer Programs; Education*

**20020040007** Defense Manpower Data Center, Survey and Program Evaluation Div., Arlington, VA USA

**1999 Survey of Active Duty Personnel: Administration, Datasets, and Codebook**

Wright, Laverne C.; Williams, Kristin; Willis, Elizabeth J.; Dec. 2000; 275p; In English; Original contains color images

Report No.(s): AD-A386289; DMDC-2000-005; No Copyright; Avail: Defense Technical Information Center (DTIC)

At the request of the Office of the Deputy Assistant Secretary of Defense for Personnel Support, Families, and Education, the Defense Manpower Data Center (DMDC) conducted the survey to assess perceptions of military life issues. After an extensive survey development process in which focus group research played a significant role, the 1999 Survey of Active Duty Personnel (Form A) was administered from August 1999 through December 1999. It was fielded to a nonproportional stratified, single stage random sample of 66,040 DoD Service members DoD and the Coast Guard. The (weighted) response rate was 51%, which is typical for large-scale surveys of DoD military personnel. This codebook documents survey development, sample design and allocation, survey administration procedures, and datasets that resulted from the survey. The survey's items can be grouped broadly into several categories: assignment information; career information; military life; programs and services; family information; economic issues; and background information. Data were collected by mail with procedures designed to maximize response rates. Beginning in late August 1999, an introductory letter explaining the survey and soliciting cooperation was sent to members. The introductory letter was followed about three weeks later by a package containing the questionnaire and instructions for completing and returning the survey. A third letter was sent to thank individuals who had already returned the questionnaire and to ask those who had not completed and returned the survey to do so. At approximately three weeks, six weeks, and nine weeks after the initial survey mailing, second, third, and fourth questionnaires with letters stressing the importance of

the survey were mailed to individuals who had not responded to previous mailings. The field closed on 4 January 2000 with all surveys received by that date,

DTIC

*Personnel; Random Sampling; Surveys*

**20020040068** General Accounting Office, Washington, DC USA

**Workforce Investment Act: Better Guidance and Revised Funding Formula Would Enhance Dislocated Worker Program**

Jeffords, James M.; Feb. 2002; 76p; In English

Report No.(s): AD-A399223; GAO-02-274; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

WIA specifies one funding source for each of the act's main client groups-adults, youths, and dislocated workers. Labor estimated that approximately 927, 000 dislocated workers would be served with these funds in program year 2000. A dislocated worker is an individual who (1) has been terminated or laid off, or who has received a notice of termination or layoff, from employment; is eligible for, or has exhausted entitlement to, unemployment insurance or is not eligible but has been employed for a sufficient duration to demonstrate attachment to the workforce; and is unlikely to return to previous industry or occupation; (2) has been terminated or laid off, or has received a notice of termination or layoff, from employment as a result of any permanent plant closure of, or substantial layoff at, a plant, facility, or enterprise; (3) was self employed but is unemployed as a result of general economic conditions in the community in which the individual resides or because of natural disasters; or (4) is a displaced homemaker.

DTIC

*Labor; Federal Budgets*

**20020040335** Naval Research Lab., Washington, DC USA

**A Methodology, a Language, and a Tool to Provide Information Security Assurance Arguments**

Park, Joon; Moore, Andrew; Montrose, Bruce; Strohmayer, Beth; Froscher, Judith; Feb. 15, 2002; 17p; In English

Report No.(s): AD-A399505; NRL/MR/5540--02-8600; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As information systems become more complex and industry and military rely more on their correct operation, the need for survivable, secure systems becomes more pressing. System designers and assessors need to clearly understand the causality, relationships, vulnerabilities, threats, system-level view points, and objectives of an entire enterprise. to design a system that can be trusted or assess security properties in a system, the related assurance arguments need to be developed and described effectively in a well-organized format by means of a sound language. to satisfy this requirement, we introduce a methodology, ECM (Enterprise Certification Methodology), to derive and organize the related assurance arguments effectively. We have developed a visual language, CAML (composite Assurance Mapping language), to build the map of the assurance argument using ECM. This map depicts the claim trees for the assurance arguments related to the enterprise security objective. We have also developed a tool, VRNM (Visual Network Rating Methodology), to help users develop a map to assurance arguments in CAML based on 11CM and document it with related descriptions in a common environment.

DTIC

*Information Systems; Certification; Warning Systems*

**20020040364** Assistant Secretary of Defense (Public Affairs), Directorate for Freedom of Info and Security Review, Washington, DC USA

**DoD Freedom of Information Act Handbook**

Jan. 2002; 13p; In English

Report No.(s): AD-A399340; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This handbook is intended to assist in making Freedom of Information Act (FOIA) requests for Department of Defense (DoD) records. It will get one started and provides one with a brief description of your rights and the manner in which DoD will respond to your requests. The information contained herein is not intended to be definitive or exhaustive.

DTIC

*Handbooks; Information*

**20020040368** Naples Univ., Italy

**Multimedia Information Systems**

Adali, S.; Tripathi, S.; Nov. 2001; 206p; In English; 7th, 7-9 Nov. 2001, Capri, Italy

Contract(s)/Grant(s): N681171-01-M-6165

Report No.(s): AD-A399343; R/D-9206-EE-03; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This report contains the proceedings of the MIS 2001, the 7th workshop on Multimedia Information Systems. MIS 2001 is the seventh of a series of workshops that started in 1995 with the aim of fostering interdisciplinary discussions and research in all aspects of multimedia information systems, in all their diversity. MIS 2001 will be held in Capri (Italy), November 7-9, 2001. MIS 2001 follows upon the success of the six workshops in this series that were held in Arlington (VA), West Point (NY), Como (Italy), Istanbul (Turkey), Indian Wells (CA) and Chicago (IL). The aim of this workshop is to bring together experts in all aspects of multimedia information systems, digital media content, multimedia database systems, networking, real-time systems, graphics and visualization, artificial intelligence, and algorithms. For this workshop we received about 50 papers submitted from about 10 countries around the world. More than 20 reviewers were proposed by the members of the program committee. Each paper was sent to three reviewers whose expertise matched the topic of the papers. It was decided to accept 20 high quality research papers. During MIS 2001 we will have two invited talks by V.S. Subrahmanian and Maria-Luisa Sapino, 6 research sessions on Image Retrieval, Query Processing and Indexing, Multimedia Presentations, Multimedia Information Retrieval, Multimedia Networking and Streaming, Data Models, and a panel session about the new trends in Multimedia Computing.

DTIC

*Information Systems; Multimedia; Information Retrieval; Data Retrieval; Data Bases*

**20020040369** Assistant Secretary of Defense (Public Affairs), Directorate for Freedom of Info and Security Review, Washington, DC USA

**DoD Freedom of Information Act Program Report, FY 2000**

Jan. 2000; 34p; In English

Report No.(s): AD-A399342; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During fiscal year (FY) 2000, a total of 96,479 public requests for records under the Freedom of Information Act (FOIA) were completed by the Department of Defense (DoD). In the processing of these cases, the Department of Defense fully denied 2,367 and partially denied 11,551 out of 97,266 requests on the basis of FOIA exemptions. Of those exemptions, 7% were for classified information; 6% for internal rules and practices; 7% for statutory exemptions; 6% for proprietary data; 10% for deliberative material; 39% for privacy information; and 24% for law enforcement investigations. Thirty thousand and eighty (30,080) requests could not be filled in whole or in part for other reasons, such as lack of records, referral to another agency, or lack of specificity sufficient to identify the requested records. There were 1,058 actions taken on appeals of denied requests (39 granted, 193 partially denied, 473 fully denied, and 357 not filled for other reasons, as mentioned earlier). The total DoD operating cost associated with the processing of requests during this report period was 536,526.67 1.09. The average cost of processing a single case during this period was approximately \$378.60. Fee collections for records provided to the public amounted to \$666,362.64 (1.8% of total program cost).

DTIC

*Armed Forces; Law (Jurisprudence); Procedures*

**20020040370** Assistant Secretary of Defense (Public Affairs), Directorate for Freedom of Info and Security Review, Washington, DC USA

**DoD Freedom of Information Act Program Report, FY 2001**

Jan. 2001; 18p; In English

Report No.(s): AD-A399341; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During fiscal year (FY) 2001, a total of 80,357 public requests for records under the Freedom of Information Act (FOIA) were completed by the Department of Defense (DoD). In the processing of these cases, the Department of Defense fully denied 2,172 and partially denied 11,371 out of 80,357 requests on the basis of FOIA exemptions. Of those exemptions, 6% were for classified information; 7% for internal rules and practices; 6% for statutory exemptions; 6% for proprietary data; 9% for deliberative material; 37% for privacy information; and 29% for law enforcement investigations. Twenty three thousand, five hundred and sixteen (23,516) requests could not be filled in whole or in part for other reasons, such as lack of records, referral to another agency, or lack of specificity sufficient to identify the requested records. There were 927 actions taken on appeals of denied requests (34 granted, 176 partially denied, 436 fully denied, and 281 not filled for other reasons, as mentioned earlier). The total DoD operating cost associated with the processing of requests during this report period was \$39,712,317. The average cost of processing a single case during this period was approximately \$494.20. Fee collections for records provided to the public amounted to \$652,515.53 (1.6% of total program cost).

DTIC

*Privacy; Law (Jurisprudence); Cost Analysis; Armed Forces; Laws*

**20020040392** Texas A&M Univ., College Station, TX USA

**Marshal of the Royal Air Force Sir John Cotesworth Slessor and the Anglo-American Air Power Alliance, 1940-1945**

Connolly, Corvin J.; Dec. 2001; 327p; In English

Report No.(s): AD-A399435; CI02-19; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

Sir John C. Slessor (1897-1979) was one of Great Britain's most influential airmen of the Second World War. He played a remarkable and extensive role in building the Anglo-American air power partnership as an air planner on the Royal Air Force Staff, the British Chiefs of Staff, and the Combined Chiefs of Staff. In these capacities he was a significant coalition builder that coordinated military strategy with America in 1940-41, helped create an Anglo-American bomber alliance in 1942, and drafted the compromise formula at the Casablanca Conference breaking the deadlock in the Anglo-American debate on strategy. Slessor was also instrumental in defeating the U-boat menace as RAF Coastal Commander, and later shared responsibility for directing Allied air operations in the Mediterranean. Few aspects of this vast worldwide association escaped some manner of his influence. The training of pilots, the procurement of aircraft, and the interchange of operational intelligence and information on countless subjects-all of these depended in varying degrees on Slessor. His efforts in Anglo-American operational planning paved the way for a degree of cooperation and combined action never before equaled by the military forces of two great nations. Slessor's influence had a lasting effect on the conduct of military relations between the USA and Great Britain. The passing of time has obscured his name and the significance of the wartime special relationship. This is the first major examination of Slessor, and is intended to rectify serious historical neglect.

DTIC

*Military Operations; Personnel; Biography*

**20020040566** Air Univ., Maxwell AFB, AL USA

**Air University Press Publications**

Jan. 2002; 61p; In English

Report No.(s): AD-A399183; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

AU Press publishes books, monographs, and occasional papers, and provides publishing support to the US Air Force's professional journal the Aerospace Power Journal, which is printed in English, Portuguese, and Spanish. Our publications program is designed primarily to help Air Force and other US war fighters, national leaders and policy makers, academicians, military historians, and other analysts understand and apply air and space power in peacetime and conflict. These publications are the results of unique research by military authors and civilian scholars.

DTIC

*Research and Development; Military Technology; Documents; Education*

**20020040812** General Accounting Office, Washington, DC USA

**VA INFORMATION TECHNOLOGY. Progress Made, But Continued Management Attention is Key to Achieving Results**

Mar. 13, 2002; 31p; In English

Report No.(s): AD-A399685; GAO-02-369T; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over the past year, VA has clearly benefited from the commitment of the secretary and other top leaders to addressing critical weaknesses in the department's management of information technology. As a result of their leadership, VA has made important strides in raising corporate awareness of the department's needs and in articulating and acting upon a vision for achieving improvements in key areas of IT performance. Despite this progress, however, many aspects of VA's IT environment remain troublesome, and our message today reflects concerns that we have long viewed as significant impediments to the department's effective use of IT to achieve optimal agency performance. As such, VA has more work to accomplish before it can point to real improvement in overall program performance and be assured that IT has a stable, reliable, and modernized systems environment to effectively support critical agency decision making and operations. In an area of growing importance, VA has taken key steps in laying the groundwork for an integrated, department wide enterprise architecture--a blueprint for evolving its information systems and developing new systems that optimize their mission value. Crucial executive support has been established and the department has put in place a strategy to define products and processes that are critical to its development. VA is also currently recruiting a chief architect to assist in implementing and managing the enterprise architecture. Significant work, nonetheless, is still required before the department will have a functioning enterprise architecture in place for acquiring and utilizing information systems across VA in a cost-effective and efficient manner.

DTIC

*Information Systems; Personnel*

**20020040856** Center for Mathematics and Computer Science, Amsterdam Netherlands

**Navigating through a Forest of Quad Trees to Spot Images in a Database. Information Systems**

Bosch, H. G. P.; Nes, N.; Kersten, M. L.; Feb. 2000; 16p

Report No.(s): PB2002-103040; INS-R0007; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

This paper describes how we maintain color and spatial index information on more than 1,000,000 images and how we allow users to browse the spatial color feature space. We break down all our images in color-based quad trees and we store all quad trees in our main-memory database. We allow users to browse the quad trees directly, or they can pre-select images through our color bit vector, which acts as an index accelerator. A Java based GUI is used to navigate through our image indexes.

NTIS

*Data Bases; Information Systems; Data Structures; Trees (Mathematics)*

**84**

**LAW, POLITICAL SCIENCE AND SPACE .POLICY**

*Includes: aviation law; space law and policy; international law; international cooperation; and patent policy*

**20020039151** Lembaga Penerbangan dan Antariksa Nasional, Bidang Analisis Sistem Kedirgantaraan, Jakarta, Indonesia

**Impact of the End of the Cold War to MTCR *Dampak Berakhirnya Perang Dingin Terhadap MTCR***

Pakpahan, Mangala, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; June 2001; ISSN 0126-9754; Volume 3, No. 2, pp. 79-85; In Malay-Indonesian; Copyright; Avail: Issuing Activity

Missile Technology Control Regime (MTCR) is an informal multilateral agreement, The objectives of MTCR is to limit the proliferation of delivery system of nuclear, chemical and biological mass destruction weapons by controlling export or transfer of equipment and technology of aerospace launch vehicle capable of such delivery, including the supporting technology. Indonesia has the interest in MTCR, but the Indonesia position up to now have not signed the agreement yet. However, it is important for Indonesia to keep monitoring the activities of MTCR and continually evaluate the position. The information about the motivation of other countries in signing the agreement is considered to be important. After carrying out the descriptive analysis, it is found that the interest to sign the agreement is significantly increased after the end of the cold-world war.

Author

*International Relations; Missile Control; Warfare*

**89**

**ASTRONOMY**

*Includes observations of celestial bodies, astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.*

**20020039146** Johns Hopkins Univ., Dept. of Physics and Astronomy, Baltimore, MD USA

**Dynamics of cD Clusters of Galaxies, 4, Conclusion of a Survey of 25 Abell Clusters**

Oegerle, William R., Johns Hopkins Univ., USA; Hill, John M., Arizona Univ., USA; Jul. 25, 2001; 56p; In English

Contract(s)/Grant(s): NAGW-2988; NAG5-3042; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We present the final results of a spectroscopic study of a sample of cD galaxy clusters. The goal of this program has been to study the dynamics of the clusters, with emphasis on determining the nature and frequency of cD galaxies with peculiar velocities. Redshifts measured with the MX Spectrometer have been combined with those obtained from the literature to obtain typically 50 - 150 observed velocities in each of 25 galaxy clusters containing a central cD galaxy. We present a dynamical analysis of the final 11 clusters to be observed in this sample. All 25 clusters are analyzed in a uniform manner to test for the presence of substructure, and to determine peculiar velocities and their statistical significance for the central cD galaxy. These peculiar velocities were used to determine whether or not the central cD galaxy is at rest in the cluster potential well. We find that 30 - 50% of the clusters in our sample possess significant subclustering (depending on the cluster radius used in the analysis), which is in agreement with other studies of non-cD clusters. Hence, the dynamical state of cD clusters is not different than other present-day clusters. After careful study, four of the clusters appear to have a cD galaxy with a significant peculiar velocity. Dressler-Shectman tests indicate that three of these four clusters have statistically significant substructure within 1.5/(sub 75) Mpc of the cluster center. The dispersion 75 of the cD peculiar velocities is 164 +41/-34 km/s around the mean cluster velocity. This represents a significant detection of peculiar cD velocities, but at a level which is far below the mean velocity dispersion for this sample of

clusters. The picture that emerges is one in which cD galaxies are nearly at rest with respect to the cluster potential well, but have small residual velocities due to subcluster mergers.

Author

*Elliptical Galaxies; Galactic Clusters; Dynamic Characteristics; Velocity Distribution; Kinematics*

**20020039167** Hawaii Univ., Inst. of Astronomy, Honolulu, HI USA

**The Solar System Beyond Neptune Final Report, 1 Apr. 1997 - 31 Dec. 2001**

Jewitt, David, Hawaii Univ., USA; Mar. 11, 2002; 3p; In English

Contract(s)/Grant(s): NAS5-4669; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This proposal supported deep and wide-field optical imaging of the trans-Neptunian Solar System capitalizing on our broad access to state-of-the-art facilities on Mauna Kea. Key quantities determined include the size distribution of Kuiper Belt objects (a differential power law with an index  $-4$ ), and the inclination and radial distance distributions. We identified an outer edge to the classical Kuiper Belt that has since been confirmed by independent workers. We also obtained an assessment of the population densities in the mean-motion resonances with Neptune and discovered the Scattered Kuiper Belt Object dynamical class. Scientific issues on which these measurements have direct bearing include the collisional environment of the Kuiper Belt, the origin of the short-period comets, and the origin by capture into resonance of Pluto and other Kuiper Belt objects.

Author

*Imaging Techniques; Neptune (Planet); Solar System; Kuiper Belt*

**20020039325** Lembaga Penerbangan dan Antariksa Nasional, Bidang Matahari dan Lingkungan Antariksa, Jakarta, Indonesia

**Crescent Visibility in Indonesia Visibilitas Hilal di Indonesia**

Djamaluddin, T., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; October 2000; ISSN 0126-9754; Volume 2, No. 4, pp. 137-145; In Malay-Indonesian; Copyright; Avail: Issuing Activity

Research on crescent visibility in Indonesia has not been conducted yet systematically based on astronomical analysis to obtain the criteria of possibility of crescent sighting. While, the criteria are needed in determining the beginning of Islamic calendar, especially for Ramadhan, Shawal, and Zulhijjah. This analysis is conducted to overcome such a problem, by using documentation of crescent sighting during 1962-1997 in Indonesia. The results can be concluded as follows: Crescent sighting with low altitude tends to be reported from less than 3 location, likely due to misjudging of foreground object (e.g. lamp) considered as crescent. Misjudging of the crescent due to misidentification of planet Venus or Mercury is proved for low altitude crescent sighting. After eliminating foreground and background objects, it is obtained the criteria of crescent visibility in Indonesia: (1). Moon age should be greater than 8 hours. (2). Moon-Sun angle should be greater than 5,6 deg. (3). Moon-Sun altitude difference should be greater than 3 deg (crescent's altitude greater than 2 deg) for Moon-Sun azimuth difference of approx. 6 deg, while for Moon-Sun azimuth difference less than 6 deg, it is needed more altitude difference. For Moon-Sun azimuth difference of about 0 deg, the altitude difference should be greater than 9 deg.

Author

*Visibility; Azimuth; Astronomy; Indonesia*

**20020039420** NASA Ames Research Center, Moffett Field, CA USA

**Effect of Cyclic Aeroconvective Heating on Flexible Thermal Insulations**

Kourtides, Demetrius A., NASA Ames Research Center, USA; Zambrano, Brian, California Polytechnic State Univ., USA; Kowalski, Tom, Thermoscience Inst., USA; [1995]; 1p; In English; 41st International Symposium and Exhibition of the Society for the Advancement of Material and Process Engineering, 25-28 Mar. 1996, Anaheim, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA

Contract(s)/Grant(s): RTOP 242-20-02; No Copyright; Avail: Issuing Activity; Abstract Only

This paper describes the effect of cyclic aeroconvective heating on the thermal performance of ceramic flexible insulations considered for potential use as thermal protection systems or thermal insulations for future hypersonic vehicles such as the Reusable Launch Vehicles (RLV's) and other applications where structures require thermal protection from severe heating. The thermal response of these materials after exposure to cyclic aeroconvective heating from a plasma arc is described. The thermal insulations evaluated were Composite Flexible Blanket Insulations composed of an outer layer of aluminoborosilicate fabric and alumina insulation. The insulations were evaluated with and without a high emissivity coating. These insulations were exposed to the plasma arc stream for nine minutes reaching surface temperatures of 1150 C and a heat flux of 10.5 W/sq cm. Insulations were exposed three, six, or nine times in order to demonstrate reusability and to determine the effect of coatings on the surface durability of these insulations. Test results demonstrated the capability of these insulations to protect either composite or metallic structures from high heating environments. It is shown that high emittance coatings reduce backface temperatures. The durability

of these insulations when impacted at low velocities was also demonstrated. The interaction of the coatings with the ceramic fibers was characterized. An analytical thermal model was utilized to correlate experimental thermal test results with calculated values.

Author

*Thermal Protection; Surface Temperature; Aluminum Oxides; Reusable Launch Vehicles; Heat Flux; Ceramic Fibers*

**20020039433** NASA Ames Research Center, Moffett Field, CA USA

**Intensity and Self-Broadening Measurements of the 01(exp 1)21-00(exp 0)01 CO<sub>2</sub> Perpendicular Band at 5315/cm**

Giver, Lawrence P., NASA Ames Research Center, USA; Chackerian, Charles, Jr., NASA Ames Research Center, USA; Spencer, Mark N., NASA Ames Research Center, USA; Brown, Linda R., Jet Propulsion Lab., California Inst. of Tech., USA; Wattson, Richard B., Utah State Univ., USA; [1995]; 1p; In English; Seventh International Conference on Laboratory Research for Planetary Atmosphere, 8 Oct. 1995, Kona, HI, USA

Contract(s)/Grant(s): RTOP 154-50-80; No Copyright; Avail: Issuing Activity; Abstract Only

The near-infrared thermal emission windows in the spectrum of the night-side of Venus have stimulated new determinations of the intensities of weak CO<sub>2</sub> bands which are prominent absorption features in Venus spectra. Parameters for many unmeasured bands have been recomputed for the HITRAN compilation using direct numerical diagonalization (DND) [Wattson and Rothman, J.Q.S.R.T. 48, 763 (1992)]. to assess these HITRAN values, we have been measuring several of these bands on spectra which were obtained using the Kitt Peak McMath FTS and 6-meter White cell. Last year we presented preliminary intensity measurements of the 01(exp 1)21-00(exp 0)01 perpendicular band and 4 associated hot bands, Five additional McMath FTS spectra have now been obtained covering the region 3800 to 8400/cm. This permits us to finalize our intensity measurements, and to make an assessment of their uncertainties. We anticipate that these measured values will help improve further DND calculations of many weak unmeasurable bands. In addition, self-broadening parameters were determined for some lines of the 01(exp 1)21-00(exp 0)01 perpendicular band on spectra obtained with 65 and 80 torr of CO<sub>2</sub>. Because of the large spectral range, these measurements could be compared directly to self-broadening parameters of corresponding parallel. band lines measured on the same spectra. This procedure eliminates several possible sources of systematic errors that are important when attempting to determine whether or not corresponding rotational lines in different overtone-combination bands have significant differences. Our measurements thus far have found self-broadening parameters for the 01(exp 1)21-00(exp 0)01 perpendicular band to be slightly larger than similar measurements for the 30(exp 0)14-00(exp 0)01 parallel band at 6076/cm.

Author

*Absorption Spectra; Spectral Bands; Thermal Emission; Pressure Broadening*

**20020039543** NASA Ames Research Center, Moffett Field, CA USA

**Advances in Detector Technology for Infrared Astronomy**

McCreight, Craig, NASA Ames Research Center, USA; [1995]; 1p; In English; Symposium on Thermal Science and Engineering, 14 Nov. 1995, Berkeley, CA, USA

Contract(s)/Grant(s): RTOP 233-02-05; No Copyright; Avail: Issuing Activity; Abstract Only

Progress in semiconductor materials and processing technology has allowed the development of infrared detector arrays with unprecedented sensitivity, for imaging and spectroscopic applications in astronomy. The earlier discrete-detector approach has been replaced by large-element (up to 1024 x 1024 pixel), multiplexed devices. Progress has been made against a number of key limiting factors, such as quantum efficiency, noise, spectral response, linearity, and dark current. Future developments will focus on the need for even larger arrays, which operate at higher temperatures.

Author

*Infrared Astronomy; Semiconductors (Materials); Infrared Detectors; Imaging Techniques*

**20020039549** Nomad Research, Inc., Arnold, MD USA

**The Nature of Ultraluminous Galaxies: Infrared Space Observatory Analysis and Instrument Team Final Report, 1 Oct. 2000 - 30 Sep. 2001**

Satyapal, Shobita, Nomad Research, Inc., USA; [2001]; 2p; In English

Contract(s)/Grant(s): NAS5-10042; NAG5-10021; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The scientific goal of the proposed research was to investigate the physical conditions in the nuclear regions of infrared luminous galaxies by carrying out detailed infrared spectroscopic observations of a large sample of infrared luminous galaxies. During the past year, these observations have been successfully analyzed and extensive modeling using photoionization and photodissociation codes has been carried out. Two first-author publications and a second-author publication have been submitted to the Astrophysical Journal and results were presented at two invited talks. Four additional journal papers are in preparation and will be submitted during year 2 of the grant. The secondary project included in this program was the development of a near-infrared

cryogenic Fabry-Perot interferometer for use on future large aperture telescopes. System integration and room temperature testing was successfully carried out for this project during year 1.

Author

*Galaxies; Infrared Space Observatory (ISO); Luminosity; Fabry-Perot Interferometers; Infrared Spectroscopy*

**20020039551** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Nanotechnology Infrared Optics for Astronomy Missions Annual Report, 1 Apr. 2001 - 31 Mar. 2002**

Smith, Howard A., Smithsonian Astrophysical Observatory, USA; February 2002; 58p; In English

Contract(s)/Grant(s): NAG5-9363; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The program "Nanotechnology Infrared Optics for Astronomy Missions" will design and develop new, nanotechnology techniques for infrared optical devices suitable for use in NASA space missions. The proposal combines expertise from the Smithsonian Astrophysical Observatory, the Naval Research Laboratory, the Goddard Space Flight Center, and the Physics Department at the Queen Mary and Westfield College in London, now relocated to the University of Cardiff, Cardiff, Wales. The method uses individually tailored metal grids, and layered stacks of metal mesh grids, both inductive (free-standing) and capacitive (substrate-mounted), to produce various kinds of filters. The program has the following goals: (1) Model FIR filter properties using electric-circuit analogs, and near-field, EM diffraction calculations; (2) Prototype fabrication of meshes on various substrates, with various materials, and of various dimensions; (3) Test of filter prototypes, and iterate with the modeling programs; (4) Travel to related sites, including trips to Washington, D.C. (location of NRL and GSFC), London (location of QMW), Cardiff, Wales, and Rome (location of ISO PMS project headquarters); (5) Produce ancillary science, including publication of both testing on mesh performance and infrared astronomical science.

Author

*Nanotechnology; Infrared Astronomy; Optical Equipment; Space Missions; Mesh*

**20020039636** NASA Ames Research Center, Moffett Field, CA USA

**On M31's Double Nucleus**

Miller, R. H., NASA Ames Research Center, USA; Smith, B. F., NASA Ames Research Center, USA; [1995]; 1p; In English

Contract(s)/Grant(s): RTOP 399-20-16-12; No Copyright; Avail: Issuing Activity; Abstract Only

The recent HST discovery of a double nucleus in M31 brings into prominence the question how long, a second core can survive within the nuclear regions of a galaxy. Physical conditions in the nuclear regions of a typical galaxy help a second core survive, so it can orbit for a long time, possibly for thousands of orbits. Given the nearly uniform mass density in a core, tidal forces within a core radius are compressive in all directions and help the core survive the buffeting it takes as it orbits near the center of the galaxy. We use numerical experiments to illustrate these physical principles. Our method allows the full power of the experiments to be concentrated on the nuclear regions. Spatial resolution of about 0.2 pc comfortably resolves detail within the 1.4 parsec core radius of the second, but brighter core (P1) in M31. We use these physical principles to discuss M31's double nucleus, but they apply to other galaxies as well, and in other astronomical situations such as dumbbell galaxies, galaxies orbiting near the center of a galaxy cluster, and subclustering in galaxy clusters. The experiments also illustrate that galaxy encounters and merging are quite sensitive to external tidal forces, such as those produced by the gravitational potential in a group or cluster of galaxies.

Author

*Gravitational Fields; Nuclei; Galaxies*

**20020040085** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Studying X-Ray Binaries with High Energy Frequency Quasi-Periodic Oscillations Annual Report, 1 Apr. 2001 - 31 Mar. 2002**

Kaaret, P., Smithsonian Astrophysical Observatory, USA; March 2002; 6p; In English

Contract(s)/Grant(s): NAG5-7405; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of this investigation is to further our understanding of the dynamics of secreting neutron stars and black holes in the hope of using these systems as probes of the physics of strong gravitational fields. The main focus of this work has been a multi-year program of simultaneous millisecond X-ray timing and spectral observations carried out with the Rossi X-Ray Timing Explorer (RXTE) to perform the X-ray timing and one of the satellites Asca, BeppoSAX, or Chandra to perform X-ray spectral measurements. With the advent of Chandra, we have extended our work to include extragalactic X-ray binaries. We conducted a comprehensive study of the X-ray and radio behavior of the Black Hole Candidate (BHC) X-ray transient XTE J1550-564 using RXTE, Chandra, and the Australian Telescope Compact Array (ATCA). We showed that strong radio emission is associated with major X-ray outbursts involving an X-ray state transition, while a compact radio jet is seen in the low/hard X-ray state found in

the outburst decay. Interesting, the total energy required to produce the compact jet may be a substantial fraction of the total accretion energy of the system in that state. We also performed a detailed study of the spectral and timing properties of the decay. In joint RXTE/BeppoSAX observations of the neutron-star X-ray binary Cyg X-2, we discovered a correlation between the timing properties (the frequency of the horizontal branch oscillations) and the properties of a soft, thermal component of the X-ray spectrum. We showed that more detailed measurements of this source may lead to constraints on models of the accretion flow and the emission of X-ray from accreting neutron stars. We have completed analysis of RXTE observations of the X-ray transient SAX J1750.8-2900 made after detection of X-ray bursts from the source with the BeppoSAX Wide-Field Camera. We discovered millisecond oscillations in both the persistent emission and in the X-ray bursts.

Derived from text

*X Ray Binaries; Stellar Oscillations; Stellar Mass Accretion; Neutron Stars; Black Holes (Astronomy)*

## 90 ASTROPHYSICS

*Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.*

**20020039147** Science Applications International Corp., Chantilly, VA USA

### **Unambiguous Spectral Evidence for High- (and Low-) Calcium Pyroxene in Asteroids and Meteorites**

Sunshine, J. M., Science Applications International Corp., USA; Bus, S. J., Hawaii Univ., USA; Burbine, T. H., National Museum of Natural History, USA; McCoy, T. J., National Museum of Natural History, USA; Binzel, R. P., Massachusetts Inst. of Tech., USA; [2001]; 2p; In English

Contract(s)/Grant(s): NASw-00012; NAG5-3871; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Spectroscopy remains a powerful tool for inferring the modal mineralogy and mafic mineral composition of asteroid surfaces. Since similar measurements can be made on meteorite samples, spectroscopy can help link the two populations and add spatial and geologic context to detailed geochemical knowledge derived from meteorite samples. For example, analysis of the recent NEAR-Shoemaker mission to Eros include detailed study of NIS spectra to assess the affinity of Eros to ordinary chondrites. As discussed in these studies, pyroxene (PYX) and olivine (OLV) absorption are readily detectable in the spectra. Furthermore, subtleties in band parameters (position vs. area) suggest the presence of both low- and high-calcium pyroxene (LCP and HCP), as expected from the petrology of ordinary chondrites. However unambiguous identification and detailed compositional inferences for both LCP and HCP (and OLV) are difficult from band parameters analysis. In this study, we examine spectra of S-asteroids and meteorites with the Modified Gaussian Model (MGM), an absorption band model, to explore the role of HCP in these silicate-rich spectra.

Derived from text

*Asteroids; Meteoritic Composition; Meteorites; Pyroxenes; Absorption Spectra; Calcium; Mineralogy*

**20020039158** National Museum of Natural History, Dept. of Mineral Sciences, Washington, DC USA

### **Spectral Measurements of Meteorite Powders: Implications for 433 Eros**

Burbine, T. H., National Museum of Natural History, USA; McCoy, T. J., National Museum of Natural History, USA; Jarosewich, E., National Museum of Natural History, USA; Sunshine, J. M., Science Applications International Corp., USA; [2001]; 2p; In English

Contract(s)/Grant(s): NAG5-3871; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

One of the goals of the NEAR-Shoemaker mission to 433 Eros was to determine if it has a meteoritic analog. The primary means of making such a link are the X-ray/gamma-ray spectrometers, which measure elemental compositions of the surface, and the multi-spectral imager (MSI) and near-infrared spectrometer (NIS), which measure spectral reflectance. For determining meteoritic analogs using the X-ray/gamma-ray spectrometer data, the primary data used for comparison is the set of bulk chemical analyses of meteorites done by Jarosewich. These bulk chemical analyses were done on samples now found in the Smithsonian's Analyzed Meteorite Powder collection (USNM 7073). For determining meteoritic analogs using MSI/NIS spectral data, the primary data used for comparison is the set of meteoritic spectra compiled by Gaffey. To expand the set of meteoritic spectra available to the scientific community, we have initiated a spectral study of over 70 samples (primarily ordinary chondrites) found in the Smithsonian's Analyzed Meteorite Powder collection and an electron microprobe study of their corresponding thin sections. This set of spectral and compositional data should allow for better constraints on the distribution of meteorites in plots of band area ratios versus Band I centers and the usefulness of equations for deriving mineralogic compositions from band parameters. These spectral data can also be combined with previous spectral studies of other meteorite types such as the primitive achondrites, eucrites, and angrites to determine how useful the derived band parameters are for differentiating between different meteorite

classes. These spectral data can also be used for testing the Modified Gaussian Model (MGM) for determining modal abundances and mafic mineral chemistries from reflectance spectra.

Derived from text

*Spectral Reflectance; Meteoritic Composition; Meteorites; Powder (Particles); Spectrum Analysis; Chemical Analysis; Gamma Rays; X Rays*

**20020039161** NASA Goddard Space Flight Center, Greenbelt, MD USA

**The Ionization and Metallicity of the Intervening O VI Absorber at  $z=0.1212$  in the Spectrum of H1821+643**

Tripp, Todd M., Princeton Univ. Observatory, USA; Giroux, Mark L., Colorado Univ., USA; Stocke, John T., Colorado Univ., USA; Tumlinson, Jason, Colorado Univ., USA; Oegerle, William R., NASA Goddard Space Flight Center, USA; [2001]; 26p; In English  
Contract(s)/Grant(s): NAS5-26555; NAS5-32985; NAG5-7262; GO-018165.01-97A; GO-08182.01-98A; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We use high-resolution UV (ultraviolet) spectra of the radio-quiet QSO (quasi-stellar object) H1821+643 ( $z_{\text{sub em}} = 0.297$ ), obtained with the Space Telescope Imaging Spectrograph (STIS) and the Far Ultraviolet Spectroscopic Explorer (FUSE), to study the ionization and metallicity of an intervening O VI absorption line system at  $z_{\text{sub abs}} = 0.1212$ . This absorber has the following notable properties: (1) Several galaxies are close to the sight line at the absorber redshift, including an actively star-forming galaxy at a projected distance of  $144 h_{\text{sub } 75}(\text{exp } -1)$  kpc. (2) There is a complex cluster of H I Ly(alpha) absorption lines near the O VI redshift, including at least five components spread over a velocity range of approximately  $700 \text{ km s}(\text{exp } -1)$ . (3) The strongest Ly(alpha) line in the cluster appears to be composed of a mildly saturated component with a typical b-value blended with a remarkably broad component with b approximately equals  $85 \text{ km s}(\text{exp } -1)$ . (4) The O VI absorption is not aligned with the strongest (saturated) H I absorption, but instead is well-aligned with the very broad component. (5) The only detected species (at the  $4(\sigma)$  level) are O VI and H I despite coverage of strong transitions of abundant elements (e.g., C II, C III, and C IV). Based on these constraints, we find that the absorption line properties can be produced in collisionally ionized gas with  $10(\text{exp } 5.3)$  is equal to or less than T is equal to or less than  $10(\text{exp } 5.6)$  K and  $-1.8$  is equal to or less than [O/H] is equal to or less than  $-0.6$ . However, we find that photoionization is also viable if the pathlength l through the absorbing gas is long enough; simple photoionization models require  $85$  is equal to or less than l is equal to or less than  $1900 \text{ kpc}$  and  $-1.1$  is equal to or less than [O/H] is equal to or less than  $-0.3$ . We briefly discuss how observations of X-ray absorption lines due to O VII and O VIII could be used, in principle, to break the ionization mechanism degeneracy, and we conclude with some comments regarding the nature of O VI absorbers.

Author

*Quasars; Ultraviolet Absorption; Ultraviolet Astronomy; Absorption Spectra; Metallicity; Ionization*

**20020039164** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Development and Operations of the Astrophysics Data System Annual Report, 1 Jan. - 31 Dec. 2001**

Murray, Stephen S., Smithsonian Astrophysical Observatory, USA; March 2002; 32p; In English  
Contract(s)/Grant(s): NCC5-528; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Astrophysics Data System (ADS) was represented at the AAS meeting in San Diego with an oral talk and a demonstration. The demonstration was hugely successful, especially in light of the fact that the meeting was attended by about 1,200 Physics teachers. This was a group that we had no contact with before. They were very interested in the ADS. Having made contact with this group should help to further propagate knowledge about the ADS in the Physics community and bring it to the attention of young scientists. Two new mirror sites were established, one in India and in Russia. The site in India is fully operational, the site in Russia is waiting for the data tapes to be loaded. The preprint database is already functional. The mirror site in India is expected to become a full article mirror site soon. The mirror site in Russia is expected to become a partial article mirror site in the near future. The mirror site in China now has a full article mirror. This is the second full article mirror site after the one in Japan. The mirror site at the CDS in France is working on configuring disks for another full article mirror.

Author

*Data Systems; Astrophysics; Information Systems*

**20020039165** NASA Ames Research Center, Moffett Field, CA USA

**The 2140 cm(exp -1) (4.673 Microns) Solid CO Band: The Case for Interstellar O2 and N2 and the Photochemistry of Non-Polar Interstellar Ice Analogs**

Elsila, Jamie, NASA Ames Research Center, USA; Allamandola, Louis J., NASA Ames Research Center, USA; Sandford, Scott A., NASA Ames Research Center, USA; [1996]; 61p; In English  
Contract(s)/Grant(s): RTOP 185-52-12-04; RTOP 452-33-93-03; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The infrared spectra of CO frozen in non-polar ices containing N<sub>2</sub>, CO<sub>2</sub>, O<sub>2</sub>, and H<sub>2</sub>O, and the ultraviolet photochemistry of these interstellar/precometary ice analogs are reported. The spectra are used to test the hypothesis that the narrow 2140/cm (4.673 micrometer) interstellar absorption feature attributed to solid CO might be produced by CO frozen in ices containing non-polar species such as N<sub>2</sub> and O<sub>2</sub>. It is shown that mixed molecular ices containing CO, N<sub>2</sub>, O<sub>2</sub>, and CO<sub>2</sub> provide a very good match to the interstellar band at all temperatures between 12 and 30 K both before and after photolysis. The optical constants (real and imaginary parts of the index of refraction) in the region of the solid CO feature are reported for several of these ices.

Derived from text

*Ice; Infrared Spectra; Interstellar Matter; Nitrogen; Oxygen; Carbon Dioxide; Carbon Monoxide*

**20020039427** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Infrared Spectroscopy of Star Formation in Galactic and Extragalactic Regions** *Annual Report, 1 Mar. 2001 - 28 Feb. 2002*

Smith, Howard A., Smithsonian Astrophysical Observatory, USA; March 2002; 16p; In English

Contract(s)/Grant(s): NAG5-10659; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report details work done in a project involving spectroscopic studies, including data analysis and modeling, of star-formation regions using an ensemble of archival space-based data including some from the Infrared Space Observatory's Long Wavelength Spectrometer and Short Wavelength Spectrometer, and other spectroscopic databases. We will include four kinds of regions: (1) disks around more evolved objects; (2) young, low or high mass pre-main sequence stars in star-formation regions; (3) star formation in external, bright IR (infrared) galaxies; and (4) the galactic center. During this period, work proceeded fully on track and on time. Details on workshops and conferences attended and research results are presented. A preprint article entitled 'The Far Infrared Lines of OH as Molecular Cloud Diagnostics' is included as an appendix.

Derived from text

*Infrared Spectroscopy; Molecular Clouds; Star Formation*

**20020039638** NASA Ames Research Center, Moffett Field, CA USA

**Observations of Ices in Star-Forming Regions**

Tielens, Alexander G. G. M., NASA Ames Research Center, USA; [1996]; 1p; In English; 178th IAU Symposium: Molecules in Astrophysics, 1-5 Jul. 1996, Groningen, Netherlands; Sponsored by International Astronomical Union, Unknown

Contract(s)/Grant(s): RTOP 399-20-10-13; No Copyright; Avail: Issuing Activity; Abstract Only

Ground-based, air-borne, and space-based infrared spectra of protostars show prominent absorption features at 3.08, 3.54, 4.23, 4.67, 4.9, 6.0, 6.85, and 7.6 micrometers. These features are due to simple molecules such as H<sub>2</sub>O, CH<sub>3</sub>OH, CO<sub>2</sub>, CO, OCS, and CH<sub>4</sub> in accreted icy grain mantles. These studies have revealed the presence of several independent ice components, often along the same line of sight. The observations and proposed identifications will be reviewed with the emphasis on recent results from ISO and on the organic inventory of interstellar ices. These molecular grain mantles are thought to form by accretion and reaction of gas phase species on a grain surface. Observed abundances will be compared with theoretical calculations and the important grain surface routes will be delineated. The importance of the 'diffusion' limit will be emphasized.

Author

*Methane; Methyl Alcohol; Protostars; Water; Absorption Spectra*

**20020039640** NASA Ames Research Center, Moffett Field, CA USA

**The Structural Properties of Vapor Deposited Water Ice and Astrophysical Implications**

Jenniskens, P., NASA Ames Research Center, USA; Blake, D. F., NASA Ames Research Center, USA; [1996]; 1p; In English; 1996 International Symposium on the Physics and Chemistry of Ice, 26-30 Aug. 1996, Hanover, NH, USA

Contract(s)/Grant(s): RTOP 152-13-60; Copyright; Avail: Issuing Activity; Abstract Only

Films of vapor deposited water ice at low temperature (T is less than 30 K) show a number of interesting structural changes during a gradual warmup. We would like to talk about the structure of the low temperature high density amorphous form of water ice, the process of crystallization, and some recent work on the morphological changes of water ice films at high temperature. The studies of the high density amorphous form are from in-situ electron microscopy as well as numerical simulations of molecular dynamics and have lead to new insights into the physical distinction between this high density amorphous form and the low density amorphous form. For the process of crystallization, we propose a model that describes the crystallization of water ice from the amorphous phase to cubic ice in terms of the nucleation of small domains in the ice. This model agrees well with the behavior of water ice in our electron microscopy studies and finds that pure water above the glass transition is a strong liquid. In more recent work, we have concentrated on temperatures above the crystallization temperature and we find interesting morphological changes related to the decrease in viscosity of the amorphous component in the cubic crystalline regime. Given enough time, we would

like to put these results in an astrophysical context and discuss some observed features of the frost on interstellar grains and the bulk ice in comets.

Author

*Amorphous Materials; Crystallization; Ice; Morphology; Water*

**20020039698** NASA Ames Research Center, Moffett Field, CA USA

**The Infrared Spectra of Nitriles and Related Compounds Frozen in Ar and H<sub>2</sub>O**

Bernstein, Max P., NASA Ames Research Center, USA; Sandford, Scott A., NASA Ames Research Center, USA; Allamandola, Louis J., NASA Ames Research Center, USA; [1996]; 36p; In English

Contract(s)/Grant(s): RTOP 452-22-94-06; RTOP 185-52-12-04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present the 2320-2050/cm (4.31-4.88 micron) infrared spectra of 16 solid state nitrites, isonitriles, and related compounds in order to facilitate the assignment of absorption features in a spectral region now becoming accessible to astronomers for the first time through the Infrared Space Observatory (ISO). This frequency range spans the positions of the strong C(is congruent to)N stretching vibration of these compounds and is inaccessible from the ground due to absorption by CO<sub>2</sub> in the terrestrial atmosphere. Band positions, profiles, and intrinsic strengths (A values) were measured for compounds frozen in Ar and H<sub>2</sub>O matrices at 12 K. The molecular species examined included acetonitrile, benzonitrile phenylcyanide) 9-anthracenecarbonitrile, dimethylcyanamide, isopropyl nitrile (isobutyronitrile), methylacrylonitrile, crotononitrile, acrylonitrile (vinyl cyanide), 3-aminocrotononitrile, pyr-uvonitrile, dicyandiamide, cyanamide, n-butyfisocyanide, methylisocyanoacetate, dilsopropylcarbodiimide, and hydrogen cyanide. The C(is congruent to)N stretching bands of the majority of nitrites fall in the 2300-2200/cm (4.35-4.55 micron) range and have similar positions in both Ar and H<sub>2</sub>O matrices, although the bands are generally considerably broader in the H<sub>2</sub>O matrices. In contest, the isonitriles and a few exceptional nitrites and related species produce bands at lower frequencies spanning the 2200-2080/cm (4.55-4.81 micron) range. These features also have similar positions in both Am and H<sub>2</sub>O matrices and the bands are broader in the H<sub>2</sub>O matrices. Three of the compounds (pyruvonitrile, dicyandiamide, and cyanamide) show unusually large shifts of their C(is congruent to)N stretching frequencies when changing from Ar to H<sub>2</sub>O matrices. We attribute these shifts to the formation of H<sub>2</sub>O:nitrile complexes with these compounds. The implications of these results for the identification of the 2165/cm (4.62 micron) "XCN" interstellar feature and the 4550/cm (2.2 micron) feature of various objects in the solar system are discussed.

Author

*Water; Argon; Nitriles; Infrared Spectra; Molecular Gases; Nitrites; Atmospheric Chemistry*

**20020039736** NASA Ames Research Center, Moffett Field, CA USA

**Spectrum Synthesis of Hot Water in Sunspots and Selected Cool Stars**

Carbon, D. F., NASA Ames Research Center, USA; Goorvitch, D., NASA Ames Research Center, USA; [1996]; 1p; In English; 189th Meeting of the American Astronomical Society, 12-16 Jan. 1997, Toronto, Ontario, Canada; Sponsored by American Astronautical Society, USA

Contract(s)/Grant(s): RTOP 399-20-10-03; No Copyright; Avail: Issuing Activity; Abstract Only

Very recently, Partridge and Schwenke completed an elaborate theoretical computation of the potential energy surface and dipole moment function for H<sub>2</sub>O. They have used their results to predict the positions and strengths of nearly 308 million lines. This line tabulation is the most complete now available. It extends to sufficiently high excitations that the spectra of M-stars may be modelled with greater accuracy than ever before provided the predicted line parameters of Partridge and Schwenke are themselves accurate. We have computed synthetic sunspot spectra using the Partridge and Schwenke line list and the sunspot umbral models of Maltby et al. In this display, we compare these synthetic spectra with published high resolution sunspot atlases. We demonstrate the extent to which the new line list successfully predicts the sunspot spectrum and suggest where improvements are necessary. Using the new tabulation, we also illustrate the extent to which hot stellar blankets the H, K and L passbands for select K and M star model atmospheres.

Author

*Water; Sunspots; M Stars; Spectra; Stellar Envelopes; K Stars*

**20020039751** NASA Ames Research Center, Moffett Field, CA USA

**The AstroBiology Explorer (ABE) MIDEX Mission Concept**

Ennico, Kimberly, NASA Ames Research Center, USA; Sandford, Scott, NASA Ames Research Center, USA; Cox, Sylvia, NASA Ames Research Center, USA; Ellis, Benton, NASA Ames Research Center, USA; Gallagher, Dennis, NASA Ames Research Center, USA; Gautier, Nick, NASA Ames Research Center, USA; Greene, Thomas, NASA Ames Research Center, USA; McCreight, Craig, NASA Ames Research Center, USA; Mills, Gary, NASA Ames Research Center, USA; Purcell, William,

NASA Ames Research Center, USA; [2001]; 1p; In English; Instruments, Methods and Missions for Astrobiology IV, Unknown; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): RTOP 997-24-00; No Copyright; Avail: Issuing Activity; Abstract Only

The Astrobiology Explorer (ABE) is a MIDEEX mission concept under study at NASA's Ames Research Center in collaboration with Ball Aerospace & Technologies, Corp. ABE will conduct IR spectroscopic observations to address important problems in astrobiology, astrochemistry, and astrophysics. The core observational program would make fundamental scientific progress in understanding the distribution, identity, and evolution of ices and organic matter in dense molecular clouds, young forming stellar systems, stellar outflows, the general diffuse ISM, HII regions, Solar System bodies, and external galaxies. The ABE instrument concept includes a 0.6 m aperture Cassegrain telescope and two moderate resolution ( $R = 2000-3000$ ) spectrographs covering the 2.5-16 micron spectral region. Large format ( $1024 \times 1024$  pixel or larger) IR detector arrays and bandpass filters will allow each spectrograph to cover an entire octave of spectral range or more per exposure without any moving parts. The telescope will be cooled below 50K by a cryogenic dewar shielded by a sunshade. The detectors will be cooled to approximately 8K. The optimum orbital configuration for achieving the scientific objectives of the ABE mission is a low background, 1 AU Earth driftaway orbit requiring a Delta II launch vehicle. This configuration provides a low thermal background and allows adequate communications bandwidth and good access to the entire sky over the approximate 1-2 year mission lifetime.

Author

*Astrophysics; Exobiology; Mission Planning; Stellar Systems; NASA Space Programs*

**20020039845** NASA Ames Research Center, Moffett Field, CA USA

#### **Vibrational Spectroscopy and Astrobiology**

Chaban, Galina M., NASA Ames Research Center, USA; [2001]; 1p; In English, Irvine, CA, USA

Contract(s)/Grant(s): RTOP 274-50-00-06; No Copyright; Avail: Issuing Activity; Abstract Only

Role of vibrational spectroscopy in solving problems related to astrobiology will be discussed. Vibrational (infrared) spectroscopy is a very sensitive tool for identifying molecules. Theoretical approach used in this work is based on direct computation of anharmonic vibrational frequencies and intensities from electronic structure codes. One of the applications of this computational technique is possible identification of biological building blocks (amino acids, small peptides, DNA bases) in the interstellar medium (ISM). Identifying small biological molecules in the ISM is very important from the point of view of origin of life. Hybrid (quantum mechanics/molecular mechanics) theoretical techniques will be discussed that may allow to obtain accurate vibrational spectra of biomolecular building blocks and to create a database of spectroscopic signatures that can assist observations of these molecules in space. Another application of the direct computational spectroscopy technique is to help to design and analyze experimental observations of ice surfaces of one of the Jupiter's moons, Europa, that possibly contains hydrated salts. The presence of hydrated salts on the surface can be an indication of a subsurface ocean and the possible existence of life forms inhabiting such an ocean.

Author

*Vibrational Spectra; Biological Evolution; Infrared Spectroscopy; Interstellar Matter; Molecules; Exobiology*

**20020039850** NASA Goddard Space Flight Center, Greenbelt, MD USA

#### **X-Ray Synchrotron Emission From 10-100 TeV Cosmic-Ray Electrons In The Supernova Remnant SN 1006**

Allen, G. E., National Academy of Sciences - National Research Council, USA; Petre, R., NASA Goddard Space Flight Center, USA; Gotthelf, E. V., Columbia Univ., USA; The Astrophysical Journal; Sep. 10, 2001; Volume 558, pp. 739-751; In English

Contract(s)/Grant(s): SVI-61010; Copyright; Avail: Issuing Activity

We present the results of a joint spectral analysis of RXTE PCA, ASCA SIS, and ROSAT PSPC data of the supernova remnant SN 1006. This work represents the first attempt to model both the thermal and nonthermal X-ray emission over the entire X-ray energy band from 0.12 to 17 keV. The thermal flux is described by a nonequilibrium ionization model with an electron temperature  $kT_e = 0.6$  keV, an ionization timescale  $n(\text{sub } 0)t = 9 \times 10(\text{exp } 9)/\text{cc s}$ , and a relative elemental abundance of silicon that is 10 - 18 times larger than the solar abundance. The nonthermal X-ray spectrum is described by a broken power law model with low- and high-energy photon indices  $\Gamma(\text{sub } 1) = 2.1$  and  $\Gamma(\text{sub } 2) = 3.0$ , respectively. Since the nonthermal X-ray spectrum steepens with increasing energy, the results of the present analysis corroborate previous claims that the nonthermal X-ray emission is produced by synchrotron radiation. We argue that the magnetic field strength is significantly larger than previous estimates of about 10 micro G and arbitrarily use a value of 40 micro G to estimate the parameters of the cosmic-ray electron, proton, and helium spectra of the remnant. The results for the ratio of the number densities of protons and electrons ( $R = 160$  at 1 GeV), the total energy in cosmic rays ( $E(\text{sub } \text{cr}) = 1 \times 10(\text{exp } 50)$  ergs), and the spectral index of the electrons at 1 GeV ( $\Gamma(\text{sub } e) = 2.14 \pm 0.12$ ) are consistent with the hypothesis that Galactic cosmic rays are accelerated predominantly in the shocks of

supernova remnants. Yet, the remnant may or may not accelerate nuclei to energies as high as the energy of the "knee," depending on the reason why the maximum energy of the electrons is only 10 TeV.

Author

*Spectrum Analysis; X Rays; Synchrotron Radiation; Emission; Supernova Remnants; Cosmic Rays*

**20020039966** Massachusetts Inst. of Tech., Center for Space Research, Cambridge, MA USA

**The Non-Thermal Electron Spectrum of the Supernova Remnant SN 1006**

Allen, Glenn E., Massachusetts Inst. of Tech., USA; Sturmer, Steven J., Universities Space Research Association, USA; Mar. 20, 2002; 1p; In English; APR02 Meeting of the American Physical Society, Apr. 2002, USA; Original contains color illustrations; No Copyright; Avail: Issuing Activity; Abstract Only

We present the results of a spectral analysis of a compilation of X-ray, radio, and gamma-ray data for the supernova remnant SN 1006. The data are used to constrain models of the electron spectrum of the remnant. We present the results for the electron spectrum and review the implications for cosmic-ray acceleration and the strength of the magnetic field in the remnant.

Author

*Cosmic Rays; Gamma Rays; Supernova Remnants; Spectrum Analysis*

**20020039985** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Research and Project Activities in Astrophysics Final Report, 15 Jun. 1997 - 14 Nov. 2001**

Harnden, F. Rick, Jr., Smithsonian Astrophysical Observatory, USA; February 2002; 2p; In English

Contract(s)/Grant(s): NAG5-4967; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In collaboration with G. Micela, S. Sciortino, and others at the Osservatorio Astronomico di Palermo G. S. Valens, we conducted studies of X-ray emission from normal stars, primarily via observations of several open star clusters and star forming regions (viz. the Pleiades, NGC 2516, NGC 2264, and the Orion Nebula Cluster). Our work was based on combined data from several X-ray observatories, Einstein, ROSAT, XMM-Newton and Chandra, as well as ground-based optical and radio data. Preliminary results were presented at several meetings: HEAD/AAS, November, 1997 a 195th AAS Meeting, January 2000 a Three Islands Conference, April 2000 a X-ray Astronomy 2000, September 2000 a 197th AAS Meeting, January 2001 Two Years of Science with Chandra, September 2001

Author

*X Rays; Emission; Star Clusters*

**20020040411** Boston Univ., Inst. for Astrophysical Research, Boston, MA USA

**X-ray Dips Followed by Superluminal Ejections as Evidence for An Accretion Disc Feeding the Jet in A Radio Galaxy**

Marscher, Alan P., Boston Univ., USA; Jorstad, Svetlana G., Boston Univ., USA; Gomez, Jose-Luis, Instituto de Astrofisica de Andalucia, Spain; Aller, Margo F., Michigan Univ., USA; Terasanta, Harri, Helsinki Univ. of Technology, Finland; Lister, Matthew L., National Radio Astronomy Observatory, USA; Stirling, Alastair, M., University of Central Lancashire, Preston, UK; [2002]; 12p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Accretion onto black holes is thought to power the relativistic jets and other high-energy phenomena in both active galactic nuclei (AGNs) and the "microquasar" binary systems located in our Galaxy. However, until now there has been insufficient multifrequency monitoring to establish a direct observational link between the black hole and the jet in an AGN. This contrasts with the case of microquasars, in which superluminal features appear and propagate down the radio jet shortly after sudden decreases in the X-ray flux. Such an X-ray dip is most likely caused by the disappearance of a section of the inner accretion disc, part of which falls past the event horizon and the remainder of which is injected into the jet. This infusion of energy generates a disturbance that propagates down the jet, creating the appearance of a superluminal bright spot. Here we report the results of three years of intensive monitoring of the X-ray and radio emission of the Seyfert-like radio galaxy 3C 120. As in the case of microquasars, dips in the X-ray emission are followed by ejections of bright superluminal knots in the radio jet. Comparison of the characteristic length and time scales allows us to infer that the rotational states of the black holes in these two objects are different.

Author

*X Rays; Stellar Mass Ejection; Accretion Disks; Radio Emission; Radio Galaxies*

**20020040900** NASA Ames Research Center, Moffett Field, CA USA

**Cooling of the Interstellar Medium**

Tielens, A. G. G. M., NASA Ames Research Center, USA; [1996]; 1p; In English; IRTS Symposium, 11-14 Nov. 1996, Sagamihara, Japan

Contract(s)/Grant(s): RTOP 263-10-97-03; No Copyright; Avail: Issuing Activity; Abstract Only

This talk will review the various heating and cooling processes in the interstellar medium. The most important heating processes include the photoelectric effect on dust grains and PAH molecules. Cooling of the gas in the interstellar medium is dominated by emission in the far infrared fine-structure lines of OI, CII, SiII, and CI, and the rotational transitions of CO. Which of these heating and cooling processes dominates in a given region depends on its physical and especially chemical conditions, which in turn depend themselves on the interstellar UV radiation field. As a result of the interplay of these processes, the interstellar medium is organized in various structures with distinctly different physical conditions (i.e., temperature, density, and degree of ionization). The dominant cooling lines of the neutral interstellar medium have been studied using the Kuiper Airborne Observatory, balloon-borne instruments, and recently space-based missions (IRTS, ISO). These observations have concentrated on dense regions illuminated by strong UV fields from nearby stars, so-called PhotoDissociation Regions (PDRs). These observations allow us to study in detail the interaction of UV photons observations allow us to study in detail the interaction of UV photons and the interstellar gas and dust. Detailed theoretical models have been developed for PDRs. These will be reviewed and compared to the observations. Recent space based missions have measured the dominant cooling line of the galaxy, the [CII] 158 micron line. These observations and their implications will be reviewed.

Author

*Interstellar Matter; Heating; Cooling; Photoelectric Effect; Photodissociation; Line Spectra*

**91**

**LUNAR AND PLANETARY SCIENCE AND EXPLORATION**

*Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.*

**20020039428** NASA Ames Research Center, Moffett Field, CA USA

**Science Rationale for a Micro-Met Mission to Augment InterMarsNet**

Haberle, Robert M., NASA Ames Research Center, USA; [1995]; 1p; In English; International Workshop on InterMarsNet, 28-29 Sep. 1995, Capri, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

The 2003 opportunity has the potential to carry out for the first time in Mars exploration history, coordinated measurements from the surface and from orbit that can address fundamental issues associated with the Martian global circulation and climate system. Coordinated measurements are defined here to mean collecting meteorological data from a network of 12-16 globally distributed surface stations simultaneously with an orbiter carrying an atmospheric sounder. With such measurements it is possible to define the horizontally varying (barotropic) and vertically varying (baroclinic) components of the global circulation from which the full 3-dimensional horizontal wind field can be reconstructed. It is also possible to precisely define the CO<sub>2</sub> cycle, the main component of the current climate system. InterMarsNet, as currently envisioned, consists of 3-4 landers with a supporting communications orbiter that may carry some instrumentation. The landers are likely to touch down in low latitudes and will probably be configured to optimize seismological objectives. We propose to augment the InterMarsNet meteorological objectives by flying an additional 10-15 "MicroMet" landers equipped to measure surface pressure and nothing else. Surface pressure is the most fundamental meteorological parameter and it is the easiest to measure. The sensors are light, operate with minimal power, and do not require orientation or deployment. Consequently the landers can be very small (is less than 10 kg) and 10-15 of them can be delivered by a Med-lite launcher. This would enable global network science for meteorology and, when combined with the more sophisticated measurements from the InterMarsNet landers and the simultaneous temperature and dust profiling measurements from an atmospheric sounder aboard the orbiter, it would enable us to reconstruct global scale circulation patterns.

Author

*Mars Missions; Climate; Meteorological Parameters; Baroclinity; Mars Exploration*

**20020039429** NASA Ames Research Center, Moffett Field, CA USA

**Planetary Protection and Mars Exploration**

DeVincenzi, D. L., NASA Ames Research Center, USA; [1995]; 1p; In English; AGU Fall Meeting, 11-15 Dec. 1995, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Planetary spacecraft to explore Mars are subject to international and NASA policy regarding biological cleanliness. This policy is referred to as planetary protection and it establishes guidelines to prevent biological cross-contamination of planets during solar system exploration missions. Mars mission designs and exploration strategies are incomplete without consideration of planetary protection. In this paper, the foundation for planetary protection policy will be reviewed and key issues identified. Existing guidelines governing both forward and back contamination will be summarized. Various Mars exploration scenarios will be examined and the impact of planetary protection requirements will be assessed. Technical issues that need resolution will also be identified. Finally, there will be a discussion of anticipated public attitudes concerning the risk of back contamination from Mars sample return missions.

Author

*Planetary Protection; Space Exploration; Mars Exploration; Biological Effects; Mars Missions*

**20020039430** NASA Ames Research Center, Moffett Field, CA USA

**Obliquity Experiments with a Mars General Circulation Model**

Harberle, R. M., NASA Ames Research Center, USA; Schaeffer, J., Sterling Software, Inc., USA; [1995]; 1p; In English; Division for Planetary Sciences Meeting, 8-13 Oct. 1995, Kona, HI, USA; Sponsored by Lunar and Planetary Inst., USA; No Copyright; Avail: Issuing Activity; Abstract Only

We have simulated the seasonal variation of the general circulation on Mars for obliquities of 0deg and 60deg. These obliquities represent the minimum and maximum values the planet has experienced during the past 10(exp 7) years (e.g., Laskar and Robutel, 1993, *Nature*, 361, 608-614). The model we use is the NASA/Ames Mars General Circulation Model (Pollack et al., 1993, *J. Geophys. Res.* 98, 3149-3181). We vary only the obliquity; all other model parameters are as in Pollack et al. At high obliquity, the model shows dramatic seasonal variations in the polar caps and in the structure and intensity of the circulation. At the solstices the winter cap extends to the equator. Thus, surface temperatures throughout the entire winter hemisphere are fixed at the CO<sub>2</sub> frost point. During summer surface temperatures at the poles reach 269K in the north and 295K in the south. The most notable changes to the circulation at solstice compared to our standard runs are a general weakening of the winter westerlies, a Hadley cell of greater latitudinal extent, and the development of very strong, possibly unstable, low-level jets in midlatitudes of the summer hemisphere. Surface stresses associated with these jets are sufficient to raise dust continuously. Thus, dust storms should be frequent features of the high obliquity climate. This result is independent of any desorbed regolith CO<sub>2</sub> which would raise mean surface pressures. At zero obliquity the structure of the circulation resembles that of present day equinox conditions modulated by the varying insolation associated with orbital eccentricity. Notable features include equatorial superrotation, asymmetric Hadley cells, and stronger poleward heat fluxes in the northern hemisphere. Since the poles do not receive solar energy at any time of year, permanent caps form which extend to about 70deg in each hemisphere. However, the north permanent cap is growing at a rate 40% faster than the south cap. This is due to the differences in topography, albedo, emissivity, and heat transport in each hemisphere. Thus the zero obliquity climate system appears to be evolving toward a state in which the north cap is the dominant cap.

Author

*Atmospheric General Circulation Models; Mars Atmosphere; Annual Variations; Atmospheric Circulation; Carbon Dioxide*

**20020039525** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

**A Numerical Simulation of Supersonic Turbulent Convection Relating to the Formation of the Solar System**

Prentice, Andrew J. R., Monash Univ., Australia; Dyt, C. P., Commonwealth Scientific and Industrial Research Organization, Australia; Dec. 01, 2001; 64p; In English

Contract(s)/Grant(s): NAS7-1407

Report No.(s): JPL-Publ-01-016; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A flux-corrected transport scheme is used to numerically simulate thermal convection in a two-dimensional layer of ideal, diatomic gas heated from below & stratified gravitationally across many pressure scale heights. This calculation mimics the conditions in the outer layers of the protosolar cloud [PSC] from which the Solar System formed. The temperature at the top boundary ( $z = 0$ ) & a dimensionless temperature gradient of 10 at the base of the layer of thickness it are kept fixed with time. The initial atmosphere is uniformly superadiabatic, having polytropic index  $m = 1$ . Because the Reynolds number of the real atmosphere is so large, a subgrid-scale [SGS] turbulence approximation is used to model motions whose scale is less than the computational grid size. The flow soon evolves to a network of giant convective cells spanning the whole layer. At cell boundaries the downflows are narrow & rapid while the upflows are broad & sluggish. The peak downflow Mach number is  $M = 1.1$ . The descent of the cold gas eliminates much of the initial superadiabatic structure of the lower atmosphere, so reducing the mean temperature gradient  $DT$  & causing a rise in mean density  $RHO$  towards the base. In the top 10% of depth, SGS modelling causes DART to increase sharply. A steep density inversion occurs with  $RHO$  rising to 3.5 times the initial value at the top boundary.

This result gives credibility to the Modern Laplacian Theory [MLT] of Solar System origin. Here a postulated Billfold density increase at the surface of the PSC causes the shedding of discrete gas rings at the observed mean orbital spacings of the planets. Even so, further simulations that may yield M approximately 3 & a top density upturn factor of 35 are needed for the MLT to be considered valid.

Author

*Solar System; Supersonics; Convection; Numerical Analysis; Computerized Simulation; Turbulence*

**20020039530** NASA Goddard Space Flight Center, Greenbelt, MD USA

**On Magnetic Spectra of Earth and Mars**

Voorhies, C. V., NASA Goddard Space Flight Center, USA; Sabaka, T. J., Raytheon Information Technology and Scientific Services, USA; Purucker, M., Raytheon Information Technology and Scientific Services, USA; Jan. 15, 2002; 35p; In English Contract(s)/Grant(s): RTOP 622-70-55; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The spectral method for distinguishing crustal from core-source magnetic fields is reexamined, modified, and applied to both a comprehensive geomagnetic field model and an altitude normalized magnetic map of Mars. The observational spectra are fairly fitted by theoretical forms expected from certain elementary classes of magnetic sources. For Earth we find fields from a core of radius 3512 +/- 64 km, in accord with the seismologic core radius of 3480 km, and a crust represented by a shell of random dipolar sources at radius 6367 +/- 14 km, near the planetary mean radius of 6371.2 km. For Mars we find no sign of a core-source field, only a field from a crust represented in same way, but at radius 3344 +/- 10 km, about 46 km below the planetary mean radius of 3389.5 km, and with sources about 9.6 +/- 3.2 times stronger.

Author

*Geomagnetism; Planetary Magnetic Fields; Mars (Planet)*

**20020039541** Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA

**Relationship between Jovian Hectometric Attenuation Lanes and Io Volcanic Activity**

Menietti, J. D., Iowa Univ., USA; Gurnett, D. A., Iowa Univ., USA; Spencer, J. R., Lowell Observatory, USA; Stansberry, J. A., Lowell Observatory, USA; Radio Science; November/December 2001; ISSN 0048-6604; Volume 36, No. 6, pp. 1723-1731; In English

Contract(s)/Grant(s): JPL-958779; NAG5-8918

Report No.(s): Paper-2000RS002458; Copyright; Avail: Issuing Activity

Within the Galileo plasma wave instrument data a narrow (in frequency) attenuation band is seen in the hectometric (HOM) emission that varies in frequency with system III longitude. This attenuation lane is believed to be the result of near-grazing incidence or coherent scattering of radio emission near the outer edge of the Io torus, i.e., when the ray path is nearly tangent to an L shell containing the Io flux tube. Such a process should, therefore, be enhanced when the Io volcanic activity is increased and the Io flux tube has enhanced density. We have performed a systematic study of the existing Galileo radio emission data in an effort to determine the phenomenology and frequency of occurrence of the attenuation lanes and the association, if any, with published volcanic activity of Io. Our results indicate that the attenuation lanes are present almost all of the time but are enhanced on occasion. The best examples of attenuation lanes occur when Galileo is within approximately 65 R(sub J) of Jupiter and thus are probably more apparent because of the increased signal-to-noise ratio of the radio receivers. The lack of continuous monitoring of Io activity and the lack of known activity on the anti-Earthward side of Io are problematic and make detailed correlation with radio emission very difficult at this time. Nevertheless, if the data are displayed for periods when the spacecraft is within 65 R(sub J) (i.e., for each perijove pass), then the highest-contrast lanes occur on most passes when the Io volcanic activity is also high for that pass. These results support our current understanding of attenuation lane formation and suggest that future efforts can be made to better understand the interaction of HOM emission with the Io flux tube.

Author

*Jupiter (Planet); Io; Toruses; Coherent Scattering; Volcanoes; Radio Emission; Magnetic Flux*

**20020039634** Science Applications International Corp., Chantilly, VA USA

**Mafic Intrusion in the Lunar Crust Final Report, 22 Mar. 2001 - 21 Mar. 2002**

Tompkins, Stefanie, Science Applications International Corp., USA; [2002]; 5p; In English

Contract(s)/Grant(s): NASW-24264

Report No.(s): Rept-01-1360-04-0920; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report documents progress with respect to: 1) Determining detailed lunar crust stratigraphy from impact craters, and 2) remote sensing applications of lunar impact melt spectra.

Author

*Lunar Crust; Intrusion; Impact Melts; Craters*

**20020039837** NASA Ames Research Center, Moffett Field, CA USA

**Overview of the Galileo Probe Mission to Jupiter**

Young, R. E., NASA Ames Research Center, USA; [1996]; 1p; In English; 28th Annual Meeting of Division for Planetary Sciences, 23-26 Oct. 1996, Tucson, AZ, USA; Sponsored by Lunar and Planetary Inst., USA

Contract(s)/Grant(s): RTOP 889-54-01; No Copyright; Avail: Issuing Activity; Abstract Only

The Galileo Probe entered the atmosphere of Jupiter on December 7, 1995, for the first time directly sampling the atmosphere of one of the outer planets. The entry was the most difficult ever attempted in terms of heat and deceleration loads. The probe and all scientific instruments functioned successfully, and returned data on composition, clouds, thermal structure, winds, energy balance, lightning, and inner radiation belts. A summary of major science objectives and results is presented.

Author

*Galileo Probe; Jupiter Atmosphere; Deceleration; Radiation Belts; Energy Budgets*

**20020039846** NASA Ames Research Center, Moffett Field, CA USA

**Review of Galileo Probe Entry Technology**

Milos, Frank S., NASA Ames Research Center, USA; [1997]; 1p; In English; Workshop on Aeroassist Technologies, 14-16 Jan. 1997, Pasadena, CA, USA

Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

This talk is a review of the Galileo entry mission with a focus on entry technology, not planetary science. A general description of the mission, entry parameters, and entry vehicle are provided, followed by a more detailed description of the vehicle heatshield shape, size, materials, and instrumentation. The heat shield design tools and process are discussed with emphasis on the issues and challenges which were faced and the role of ground test facilities. Flight data are compared with the preflight predictions. What have we learned?

Author

*Galileo Probe; Heat Shielding; Galileo Project; Ground Tests*

**20020039863** NASA Ames Research Center, Moffett Field, CA USA

**In Situ Mineralogical Analysis of Planetary Materials Using X-Ray Diffraction and X-Ray Fluorescence**

Sarrazin, P., NASA Ames Research Center, USA; Blake, D., NASA Ames Research Center, USA; Vaniman, D., NASA Ames Research Center, USA; [1996]; 1p; In English; American Geophysical Union Meeting, 15-19 Dec. 1996, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA

Contract(s)/Grant(s): RTOP 344-36-20; No Copyright; Avail: Issuing Activity; Abstract Only

Remote observations of Mars have led scientists to believe that its early climate was similar to that of the early Earth, having had abundant liquid water and a dense atmosphere. One of the most fascinating questions of recent times is whether simple bacterial life developed on Mars (as it did on the Earth) during this early element period. Analyses of SNC meteorites have broadened considerably our knowledge of the chemistry of certain types of Martian rocks, underscoring the tantalizing possibility of early hydrothermal systems and even of ancient bacterial life. Detailed analyses of SNC meteorites in Terrestrial laboratories utilize the most sophisticated organic, isotopic and microscopic techniques in existence. Indeed; it is unlikely that the key biogenic indicators used in McKay et al (ibid) could be identified by a remote instrument on the surface of Mars. As a result, it is probable that any robotic search for evidence of an ancient Martian biosphere will have as its focus the identification of key minerals in likely host rocks rather than the direct detection of organic or isotopic biomarkers. Even on a sample return mission, mineralogical screening will be utilized to choose the most likely candidate rocks. X-ray diffraction (XRD) is the only technique that can provide a direct determination of the crystal structures of the phases present within a sample. When many different crystalline phases are present, quantitative analysis is better constrained if used in conjunction with a determination of elemental composition, obtainable by X-ray fluorescence (XRF) using the same X-ray source as for XRD. For planetary surface analysis, a remote instrument combining XRD and XRF could be used for mineralogical characterization of both soils and rocks. We are designing a remote XRD/XRF instrument with this objective in mind. The instrument concept pays specific attention to constraints in sample preparation, weight, volume, power, etc. Based on the geometry of a pinhole camera (transmission geometry, flat two-dimensional detector perpendicular to the direct beam), the instrument (which we call CHEMIN, for Chemistry and Mineralogy) uses an X-ray sensitive CCD detector which will allow concurrent positional and energy-dispersive analysis of collected photons. Thus XRF

(energy) and XRD (geometry) analysis of transmitted X-rays will be performed at the same time. Tests performed with single minerals and simple mixtures give promising results. Refinements of the prototype promise interpretable results on complex samples.

Author

*Mineralogy; Planetary Composition; X Ray Diffraction; X Ray Fluorescence; Crystal Structure; Chemical Composition*

**20020039968** NASA Ames Research Center, Moffett Field, CA USA

**NASA Space Missions to Asteroids: Protecting the Earth from NEO Impacts**

Morrison, David, NASA Ames Research Center, USA; [1996]; 1p; In English; Space Protection of the Earth 96th Conference, 22-28 Sep. 1996, Shnezinsk, Russia; Sponsored by Russian Federal Nuclear Center, Russia

Contract(s)/Grant(s): RTOP 887-54-06; No Copyright; Avail: Issuing Activity; Abstract Only

There is now a general recognition of the hazard of impacts on Earth by comets and asteroids, but there is yet no consensus concerning international actions that should be taken to protect the planet from such impacts. An essential step in the analysis of the situation involves estimating the relative hazard posed by comets and asteroids of different sizes and orbits. All recent studies agree that the larger impacts pose the greater danger, and that our primary concern from the perspective of total risk should be on impacts that are large enough to cause global ecological catastrophe. These global catastrophes are also of special interest, since they (alone among natural disasters) have the potential to destroy civilization. Studies of the sensitivity of the Earth's environment suggest that the energy threshold energy for causing a global catastrophe is at about 1 million megatons, corresponding to impactor diameters of 1.5 to 2 km. This information leads naturally to a strategy of concentrating on the larger NEOs, say those 1 km or more in diameter. This is the rationale for the Spaceguard Survey, which must be the highest priority in mitigation efforts. The second question concerns the value of developing standing defensive systems that could deflect or destroy an incoming NEO. In the case of the asteroids larger than 1 km in diameter, no such system is needed, since there will be ample time (at least several decades) between the discovery of the threatening object by Spaceguard and the requirement to take action against it. In the case of objects smaller than 1 km diameter, development of defensive systems is not cost-effective; there are many greater dangers to persons and property that are much more urgent. Only in the case of large long-period comets is there a rationale for standing defense systems. The question is also raised whether the risks inherent in developing and maintaining a defense system might be greater than the impact risks it is intended to guard against. These and related issues are the focus of much current international debate on defense of the planet against NEO impacts. Meanwhile, the most critical issue remains the expansion of the telescopic search for NEOs.

Author

*Asteroids; NASA Space Programs; Earth (Planet); Near Earth Objects; Hypervelocity Impact*

**20020039975** NASA Ames Research Center, Moffett Field, CA USA

**Haze Formation is an Important Sink for HCN on Titan**

McKay, Christopher P., NASA Ames Research Center, USA; [1996]; 1p; In English; 28th Annual Meeting of Division for Planetary Sciences, 23-26 Oct. 1996, Tucson, AZ, USA; Sponsored by Lunar and Planetary Inst., USA

Contract(s)/Grant(s): RTOP 185-52-62-04; No Copyright; Avail: Issuing Activity; Abstract Only

Titan's organic haze is potentially an important sink of photochemically produced carbon and nitrogen compounds. An assortment of microphysical haze models all suggest that the haze production rate is  $10(\exp -14)$  gm per square centimeter per second, within a factor of two. Spectral analysis of laboratory tholins compared to Titan's geometric albedo spectrum suggest that the laboratory material is a good analog to Titan's haze. The laboratory material has an elemental composition given approximately by  $C_4H_4N$ , with an uncertainty in the C/N ratio of a factor of two. Thus, the haze represents a sink for C of  $4 \times 10(\exp 8)$  per square centimeter per second, and a sink for N of  $1 \times 10(\exp 8)$  per square centimeter per second. The C sink is small compared to condensation of hydrocarbons but the sink for N is comparable to the total production rate of HCN. Because estimates of the eddy diffusion profile on Titan have been based on the HCN profile, inclusion of this additional sink for N will affect estimates for all transport processes in Titan's atmosphere.

Author

*Haze; Hydrocyanic Acid; Titan; Photochemical Reactions*

**20020039976** NASA Ames Research Center, Moffett Field, CA USA

**Mars Invasion**

OHandley, Douglas, NASA Ames Research Center, USA; [1997]; 1p; In English; Space Education Conference, 22 Jan. 1997, Vandenberg AFB, CA, USA

Contract(s)/Grant(s): RTOP 274-52-71; No Copyright; Avail: Issuing Activity; Abstract Only

Currently there are two spacecraft headed to Mars. The Pathfinder mission is expected to land on the red planet on July 4, 1997 and the Global Surveyor will land on September 11, 1997. Both of these missions were under development prior to the August 7th announcement of the possible discovery of early life forms on Mars. Mars will be actively explored by robotics over the next decade. The ultimate exploration will be carried out by humans early in the 21st century. This talk will cover what we know and what we hope to find out in the future about Mars. It will discuss the possible human scenarios for human exploration.

Author

*Mars (Planet); Mars Missions*

## 92

### SOLAR PHYSICS

*Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.*

**20020039137** Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Matahari dan Lingkungan Antariksa, Jakarta, Indonesia

**Indonesia Stratosphere and Troposphere Response to Solar Activity Variations** *Respon Stratosfer Dan Troposfer Indonesia Terhadap Variasi Aktivitas Matahari*

Sinambela, Wilson, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Muh, La Ode, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Musafar, K., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Sutastio, Heri, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; October 2000; Volume 2, No. 4, pp. 167-177; In Malay-Indonesian; Copyright; Avail: Issuing Activity

Tropospheric and stratospheric response of Indonesia to the solar activity was analyzed based on the stratospheric total ozone concentrations above Watukosek station (07,6 deg S, 112,5 deg E) from 1979 to 1992, and tropospheric temperature at tropopause geopotential height, 500 mBar, 700 mbar above Cengkareng - Jakarta station (06 deg) 07 min 37 sec S, 106 deg 39 min 28 sec E) from 1986 to 1992, and ground surface air temperature above Polonia Median (03 deg 34 sec N, 98 deg 41 min E) and Kemayoran - Jakarta station (06 deg 09 min S 106 deg 51 min E) from 1979 - 1989. by using the moving average analysis of monthly average this tropospheric and stratospheric variable, were found that the behavior of the time series of the stratospheric ozone concentration, tropospheric temperature at geopotential height tropopause, 500 mBar, 700 mBar and ground surface air temperature above Indonesia showed a tendency to vary with a period of about 22 - 32 months. This is so - called "Quasi Biennial" (Q B 0). The behavior of the relative sunspot numbers and / or F 10,7 Cm solar radio flux as the measure of the solar activity also showed a tendency to vary Quasi - Biennially with a period about 27 - 30 months which was superimposed to the eleven - year solar cycle variations. The source of the variations was predicted from the inside of the sun, since the experiment showed that the neutrino flux from the sun varies with a period almost equal to the Quasi - Biennial variations of the solar activity. The Quasi - Biennial variations of the solar activity seems produce a similar variations on the earth atmospheric phenomena such as the stratospheric total ozone concentrations, mean tropospheric temperature at geopotential tropopause height, 500 mBar, 700 mBar, and mean ground surface air temperature above Indonesia.

Author

*Stratosphere; Troposphere; Indonesia; Solar Activity; Gas Composition; Ozone*

**20020039153** Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Matahari dan Lingkungan Antariksa, Jakarta, Indonesia

**Correlation of Solar Ultraviolet Radiation on the Earth's Surface and Solar Activity Variation During Solar Cycle 22 Decreasing Phase** *Hubungan Variasi Radiasi Ultraviolet Matahari di Permukaan Bumi dan Variasi Aktivitas Matahari Selama Fase Menurun Siklus Matahari Ke-22*

Sinambela, Wilson, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Musafar, Muhammad La Ode, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Kaloka, Sri, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; October 2000; ISSN 0126-0480; Volume 2, No. 4, pp. 195-202; In Malay-Indonesian; Copyright; Avail: Issuing Activity

The research objective is to investigate the influences of solar activity variation to the solar ultraviolet (UV - A and UV - bA) irradiance variation on the earth surface which was observed from LAPAN - Bandung (6,9 deg S; 107,6 deg E) from Mei 1992 and December 1997. by taking the moving average of 12 months of monthly average solar ultraviolet irradiance , it were found that solar UV - B irradiance matched of 12 months moving average of 12 months of solar activity variation (F10,7 cm solar radio flux); the decreasing of solar activity level during the decreasing phase of 22th solar cycle at an average rate of 16,41% per year, following by decreasing amount of solar UV - B irradiance at an average rate 10,54% per year for the time period. In contrast, the decreasing of solar UV - A irradiation, following by increasing of solar UV - A irradiance at an average rate of 7,48% per year

for the time period of observation. by using linear regression analysis, it was obtained a positive correlation between the solar flux UV - B irradiance and the F10,7 cm solar radio flux which is represented by: Solar flux UV - B irradiance (Watt/sq m) = 0.055 F10,7 cm solar radio flux [SFU]+ 0,0778, with the correlation coefficient of 0,80. In contrast, by assurance that solar activity also effects the solar UV - A irradiance, it was obtained a negative correlation between the solar UV - A irradiance and the F10,7 cm solar radio flux which is represented by: Solar flux UV - A irradiance (Watt/sq m2) = 0.037 F10,7 cm solar radio flux (SFU) + 15,008, with the negative correlation coefficient of - 0,80.

Author

*Solar Radiation; Solar Activity; Correlation Coefficients; Regression Analysis*

**20020039299** Lembaga Penerbangan dan Antariksa Nasional, Bidang Ionosfer dan Telekomunikasi, Jakarta, Indonesia

**Modeling of Solar Activity Linear Time Series and the Prediction of Maximum Cycle 23** *Pemodelan Runtut Waktu Linier Aktivitas Matahari dan Prediksi Siklus Maksimum ke-23*

Muslim, Buldan, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; March 2001; ISSN 0126-9754; Volume 3, No. 1, pp. 1-6; In Malay-Indonesian; Copyright; Avail: Issuing Activity

Modeling of solar activity have been made using linear autoregression (AR) of time series data of yearly sunspot number. Based of Akaike's Information Criterion (AIC) it has been obtained 9th order of linear AR. The model has been used for predicting solar maximum of current cycle (solar cycle 23). This simple model seems rather accurate to neural network model for several years ahead prediction of solar activity.

Author

*Solar Activity; Time Series Analysis; Mathematical Models; Predictions*

**20020039730** California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA

**Theoretical Technology Research for the International Solar Terrestrial Physics (ISTP) Program** *Final Report, 1 Nov. 1997 - 30 Sep. 2001*

Ashour-Abdalla, Maha, California Univ., USA; [2002]; 17p; In English

Contract(s)/Grant(s): NAG5-6689; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the last four years the UCLA (University of California, Los Angeles) IGPP (Institute of Geophysics and Planetary Physics) Space Plasma Simulation Group has continued its theoretical effort to develop a Mission Oriented Theory (MOT) for the International Solar Terrestrial Physics (ISTP) program. This effort has been based on a combination of approaches: analytical theory, large-scale kinetic (LSK) calculations, global magnetohydrodynamic (MHD) simulations and self-consistent plasma kinetic (SCK) simulations. These models have been used to formulate a global interpretation of local measurements made by the ISTP spacecraft. The regions of applications of the MOT cover most of the magnetosphere: solar wind, low- and high- latitude magnetospheric boundary, near-Earth and distant magnetotail, and auroral region. Most recent investigations include: plasma processes in the electron foreshock, response of the magnetospheric cusp, particle entry in the magnetosphere, sources of observed distribution functions in the magnetotail, transport of oxygen ions, self-consistent evolution of the magnetotail, substorm studies, effects of explosive reconnection, and auroral acceleration simulations. A complete list of the activities completed under the grant follow.

Author

*Geophysics; Magnetohydrodynamics; Simulation; Solar Physics*

**20020039991** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Microphysics of Waves and Instabilities in the Solar Wind and Their Macro Manifestations in the Corona and Interplanetary Space** *Annual Report, 1 Jun. 2001 - 31 May 2002*

Habbal, Shadia Rifai, Smithsonian Astrophysical Observatory, USA; March 2002; 2p; In English

Contract(s)/Grant(s): NAG5-10873; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A breakthrough resulted from the investigation of plasma heating by ion-cyclotron waves in rapidly expanding flow tubes, often referred to as coronal funnels and expected to originate in the low transition region where the temperature gradient in the solar atmosphere rises very sharply. The investigation was made using a three-fluid plasma consisting of protons, electrons and alpha particles. It was found that these waves heat the solar wind plasma by directly heating the heavier species, namely the alphas. Although only alpha particles dissipate the waves, the strong Coulomb coupling between alpha particles and protons, and between protons and electrons, makes it possible for protons and electrons to be heated also to more than one million degrees, i.e. to coronal temperatures. Interestingly, the extreme heating of the alpha particles, however, is such that they end up being hotter and faster, and are no longer in thermal equilibrium with the protons and electrons. once the rapid expansion of the flow tube is complete, the particles return to thermal equilibrium. The observational signatures of these results are such that if spectral lines formed below

a million degrees are observed at different heights in the corona, the inferred outflow velocities may vary by a factor of 5 to 6. In addition, if minor ions are indeed much faster than protons and electrons at temperatures below a million degrees, then one cannot reliably determine the bulk outflow velocity of the solar wind in that region from inferences of minor ion outflow velocities. A detailed parameter study on the resonant interaction between ion cyclotron waves and alpha particles and other minor ions is also under way. It is found that the highest frequency of the waves, or the location of the heating determines whether a thermal equilibrium can be established between minor ions and protons. As the maximum frequency is increased, alpha particles and protons become farther away from thermal equilibrium. As the maximum frequency becomes smaller, alpha particles and protons are more likely to be in thermal equilibrium. However, if the maximum frequency is below a critical value, ion cyclotron resonance occurs at a greater height and a hot corona cannot be produced.

Author

*Solar Wind; Interplanetary Space; Solar Corona; Solar Atmosphere; Plasma Heating; Ion Cyclotron Radiation*

**20020039997** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Structure and Dynamics of the Quiet Solar Chromosphere** *Final Report, 1 May 1997 - 30 Oct. 2001*

Kalkofen, Wolfgang, Smithsonian Astrophysical Observatory, USA; April 2002; 4p; In English

Contract(s)/Grant(s): NAG5-4952; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The grant supported research on the structure of the quiet, nonmagnetic chromosphere and on wave excitation and propagation in both the nonmagnetic chromosphere and the magnetic network. The work on the structure of the chromosphere culminated in the recognition that between two competing views of the solar chromosphere, older models by Avrett and collaborators (referred to as VAL) and the newer, dynamical model by Carlsson & Stein (referred to as CS), the clear decision is in favor of the older models, and this in spite of the evident lack of physics, which does not include wave motion and oscillations. The contrast between the static VAL models and the dynamical CS model can be stated most succinctly by comparing the temperature variation implied by the VAL models and the temperature fluctuations of the CS model, which are, respectively, of the order of 10% for the VAL model (at heights where hydrogen is 50% ionized) and a factor of 10 (at the upper boundary of their chromospheric model). The huge fluctuations of the CS model have never been observed, whereas the smaller temperature variations of the VAL models are consistent with ground-based and space-based observations. While it should be obvious which model describes the Sun and which one fails, the case is far from settled in the minds of solar physicists. Thus, much educational work remains to be done and, of course, more research to develop arguments that make the case more convincing. The research on waves and oscillations has been based on a unified theory of excitation of acoustic waves in the field-free atmosphere and of transverse and longitudinal waves in magnetic flux tubes located in the magnetic network by noting, first, that impulsive excitation of all these waves in gravitationally stratified media leads to oscillations at the respective cutoff frequencies and, second, that the observed oscillation frequencies in the nonmagnetic and magnetic parts of the chromosphere match corresponding cutoff frequencies in the upper solar photosphere. The dynamical simulations by Carlsson and Stein have been most instructive and of fundamental importance for understanding wave propagation in a stratified medium by their "flaws", the most important of which is an intensity excess at the H2v emission peak in the H line of Ca II, which is surprising since the observed intensity should have been an upper limit to the simulated intensity. The only plausible explanation for a predicted intensity that is higher than observed is that energy is spread horizontally in upward propagation in the Sun, but not in the plane-wave modeling of CS (as well as by almost everyone else). Investigations of the horizontal size of the region disturbed by the upward-propagating shock in the acoustic-wave propagation implies that the waves in H2v bright-point oscillations emanate from a point source with a diameter corresponding to the width of an intergranular lane, about 100 km, and reach a size of about 4000 km in the upper layers of the chromosphere. Linear, analytic modeling of waves emanating from a point source in a stratified atmosphere shows that the upward-expanding propagation channel does not have sharp boundaries and that the shape of the wave front depends on the order of the wave behind the initial pulse. Otherwise, the behavior of the linear waves resembles that of the nonlinear shock waves observed in the Sun. Research that needs to be done to firm up the conclusions reached above concerns the numerical simulations of nonlinear waves and oscillations in a three-dimensional stratified atmosphere with impulsive excitation, and observations linking directly the horizontal size of the disturbed area in upward propagation to individual waves.

Author

*Chromosphere; Solar Atmosphere; Wave Excitation; Wave Propagation; Stellar Models; Static Models; Dynamic Models*

*Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see 52 Aerospace Medicine. For theory see 73 Nuclear Physics.*

**20020039528** Massachusetts Inst. of Tech., Center for Space Research, Cambridge, MA USA

**Observations of the Non-Thermal X-ray Emission from the Galactic Supernova Remnant G347.3-0.5**

Pannuti, Thomas G., Massachusetts Inst. of Tech., USA; Allen, Glenn E., Massachusetts Inst. of Tech., USA; Neutron Stars in Supernova Remnants; 2002; Volume 9999, pp. 1-4; In English; ASP Conference, 2002, Unknown

Contract(s)/Grant(s): NAG5-9237

Report No.(s): astro-ph/0112004; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

G347.3-0.5 (ALEX J1713.7-3946) is a member of the new class of shell-type Galactic supernova remnants (SNRs) that feature non-thermal components to their X-ray emission. We have analyzed the X-ray spectrum of this SNR over a broad energy range (0.5 to 30 keV) using archived data from observations made with two satellites, the Röntgensatellit (ROSA I) and the Advanced Satellite for Cosmology and Astrophysics (ASCA), along with data from our own observations made with the Rossi X-ray Timing Explorer (RXTE). Using a combination of the models EQUIL and SRCUT to fit thermal and non-thermal emission, respectively, from this SNR, we find evidence for a modest thermal component to G347.30.5's diffuse emission with a corresponding energy of kT approx. = 1.4 keV. We also obtain an estimate of 70 TeV for the maximum energy of the cosmic-ray electrons that have been accelerated by this SNR.

Author

*X Rays; Cosmic Rays; Supernova Remnants; Thermal Emission*

**20020039840** Sydney Univ., School of Physics, Australia

**Theory of Type II Radio Emission From the Foreshock of an Interplanetary Shock**

Knock, S. A., Sydney Univ., Australia; Cairns, Iver H., Sydney Univ., Australia; Robinson, P. A., Sydney Univ., Australia; Kuncic, Z., Sydney Univ., Australia; Journal of Geophysical Research; Nov. 01, 2001; ISSN 0148-0227; Volume 106, No. A11, pp. 25,041-25,051; In English

Report No.(s): Paper-2001JA000053; Copyright; Avail: Issuing Activity

We present an analytical model for type II solar radio bursts and then apply it to an observed type II event. Electron beams are produced in the foreshock of an interplanetary shock via shock drift acceleration. Reflection is treated in the de Hoffman-Teller frame with efficiencies modeled by a loss cone that incorporates the effects of the static cross-shock potential  $\phi$ . Stochastic growth theory is used to treat electron beam driven Langmuir wave growth in the type II foreshock. Nonlinear wave-wave interactions are used as the mechanisms for converting Langmuir wave energy into freely propagating radio emission. The electron beams produced in the foreshock have a wide range of speeds and number densities. These electron beams are qualitatively consistent with observations in a type II foreshock as well as earlier theoretical predictions, and observations in Earth's foreshock. Significant levels of Langmuir waves and  $f(\text{sub } p)$  and  $2f(\text{sub } p)$  emission are predicted. In particular, the predicted volume emissivities are similar to those predicted for type III bursts. The simple model developed for the source environment of the type II event on August 26, 1998, produces fluxes in reasonable agreement with observation.

Author

*Solar Radio Bursts; Shock Waves; Electron Beams; Wave Interaction; Langmuir Turbulence*

**20020039929** Boston Univ., Inst. for Astrophysical Research, Boston, MA USA

**RXTE Observations of Selected Blazars Final Report, 15 Mar. 2000 - 14 Mar. 2002**

Marscher, Alan P., Boston Univ., USA; Jorstad, Svetlana G., Boston Univ., USA; [2002]; 2p; In English

Contract(s)/Grant(s): NAG5-9161; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The work completed includes the analysis of observations obtained during Cycles 4 and 5 of the Rossi X-ray Timing Explorer (RXTE). The project is part of a longer-term, continuing program to study the X-ray emission process in blazars in collaboration with Dr. Ian McHardy (U. of Southampton, UK).

Author

*Blazars; X Rays; Emission*

**20020039930** Boston Univ., Inst. for Astrophysical Research, Boston, MA USA

**Multifrequency Monitoring of 3C 120, 3C 279, and PKS 1510-089**

Jorstad, S. G., Boston Univ., USA; Marscher, A. P., Boston Univ., USA; Aller, M. F., Michigan Univ., USA; Balonek, T. J., Colgate Univ., USA; Gomez, J.-L., Instituto de Astrofísica de Andalucía, Spain; McHardy, I. M., Southampton Univ., UK; Terasanta, H., Helsinki Univ., Finland; Raiteri, C., Perugia Univ., Italy; Tosti, G., Osservatorio Astronomico, Italy; [2001]; 4p; In English  
Contract(s)/Grant(s): NAG5-9161; NSF AST-00-98579; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We analyze contemporaneous X-ray, optical, and radio light curves of 3C 120, 3C 279, and PKS 1510-089 on timescales from a few to hundreds of days over a 3-5 year period. The results show the diverse connections between variability properties at different frequencies for different blazars.

Author

*X Ray Optics; Radio Emission; Light Emission*

**20020039933** Boston Univ., Inst. for Astrophysical Research, Boston, MA USA

**High-Frequency Observations of Blazars**

Marscher, A. P., Boston Univ., USA; Marchenko-Jorstad, S. G., Boston Univ., USA; Mattox, J. R., Boston Univ., USA; Wehrle, A. E., Jet Propulsion Lab., USA; Aller, M. F., Michigan Univ., USA; Astrophysical Phenomena Revealed by Space VLBI; [2000], pp. 39-46; In English

Contract(s)/Grant(s): NAG5-7323; NAG5-2508; NSF AST-98-02941; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We report on the results of high-frequency VLBA observations of 42 gamma ray bright blazars monitored at 22 and 43 GHz between 1993.9 and 1997-6. In 1997 the observations included polarization-sensitive imaging. The cores of gamma ray blazars are only weakly polarized, with EVPAs (electric-vector position angles) usually within 40 degrees of the local direction of the jet. The EVPAs of the jet components are usually within 20 degrees of the local jet direction. The apparent speeds of the gamma ray bright blazars are considerably faster than in the general population of bright compact radio sources. Two X-ray flares (observed with RXTE) of the quasar PKS 1510-089 appear to be related to radio flares, but with the radio leading the X-ray variations by about 2 weeks. This can be explained either by synchrotron self-Compton emission in a component whose variations are limited by light travel time or by the Mirror Compton model.

Author

*High Frequencies; Gamma Rays; Blazars; Radio Emission*

**20020039940** Boston Univ., Inst. for Astrophysical Research, Boston, MA USA

**Time Delays of Blazar Flares Observed at Different Wavebands**

Marscher, Alan P., Boston Univ., USA; Probing the Physics of Active Galactic Nuclei by Multiwavelength Monitoring ASP Conference Series; 2001; Volume 224, pp. 23-33; In English

Contract(s)/Grant(s): NAG5-3839; NAG5-4245; NAG5-7338; NAG5-7323; NAG5-9161; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Correlated variability at different frequencies can probe the structure and physics of the jet of a blazar on size scales much smaller than can be resolved by telescopes and interferometers. I discuss some observations of frequency dependent time lags and how these place constraints on models for the nonthermal emission in blazars. The time lags can be either positive (high frequency variations leading those at lower frequencies) or negative, while simultaneous flares are also possible.

Author

*Time Lag; Blazars; Flares*

**20020039953** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Coronal Abundances In Xi Boo A, Abundances in the Corona of FK Aqr and the Origin of Cosmic Ray Annual Report, 15 Apr. 1999 - 14 Apr. 2002**

Drake, Jeremy, Smithsonian Astrophysical Observatory, USA; March 2002; 3p; In English

Contract(s)/Grant(s): NAG5-7226; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Both Xi Boo A and FK Aqr observations have been acquired, reduced and analysed. The results of the Xi Boo A study were published in ApJ (Drake, J.J., Kashyap, V., 2001, Up, 547, 428). Work is ongoing to determine the coronet metallicity of FK Aqr based on EUVE spectra and DO photometer data, using the techniques developed in the Drake & Kashyap paper. Preliminary synthetic spectra for FK Aqr have been developed, and further work to heap define the hot plasma emission measure distribution is underway. Progress on spectral analysis has been hampered following the post-doctoral scientist, Vinay Kashyap, taking up new position. A suitable replacement has been difficult to find, but new hire is expected shortly. However, good progress has been made

on analysis of DO photometric variations in FK Age, with a publication now ready (Kashyap, V., Drake, J.J., Guedel, M., Audard, M.) for submission to a mainstream astrophysical journal.

Author

*Abundance; Coronas; Cosmic Rays; Spectrum Analysis; Plasma Radiation*

**20020039995** Boston Univ., Inst. for Astrophysical Research, Boston, MA USA

**The Relationship Between X-Rays and Relativistic Jets**

Marscher, A. P., Boston Univ., USA; Jorstad, S. G., Boston Univ., USA; McHardy, I. M., Southampton Univ., UK; Aller, M. F., Michigan Univ., USA; Balonek, T. J., Colgate Univ., USA; Villata, M., Osservatorio Astronomico, Italy; Raiteri, C. M., Osservatorio Astronomico, Italy; Ostorero, L., Osservatorio Astronomico, Italy; Tosti, G., Perugia Univ., Italy; Terasranta, H., Helsinki Univ. of Technology, Finland; [2002]; 8p; In English; International Workshop on Blazar Astrophysics with BeppoSAX and other Observatories, 10-11 Dec. 2001, Frascati, Italy

Contract(s)/Grant(s): NAG5-9161; NAG5-9162; NSF AST-94-21979; NSF AST-99-00723; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We present recent multiwaveband observations centered on X-ray monitoring of blazars and the radio galaxy 3C 120 with the RXTE satellite. In 3C 120, we observed four X-ray dips, each followed by ejections of superluminal radio knots down the jet. This behavior, similar to that of the microquasar GRS 1915+105, is interpreted as infall of a piece of the inner accretion disk causing ejection of energy into the relativistic jet. The X-ray emission from the quasars PKS 1510-089, 3C 279, and 3C 273 is highly variable on timescales as short as approximately 1 day. Over 2 years, X-ray flares in PKS 1510-089 occurred about 2 weeks after radio outbursts, which can be explained by light-travel delays. In 3C 279 the X-ray and optical variations are usually well correlated, with very little, if any, time delay. We conclude that the X-ray and optical emission from blazars occurs near the radio core rather than close to the black hole.

Author

*Blazars; Quasars; Radio Galaxies; X Rays; Radio Emission*

## 99

### GENERAL

*Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.*

**20020039426** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

**Information Technology Assessment Study: Full Report**

Peterson, John, Editor, Jet Propulsion Lab., California Inst. of Tech., USA; March 2002; 302p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS7-1407

Report No.(s): JPL-Publ-02-03; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

A team was formed to assess NASA Office of Space Science (OSS) information technology research and development activities. These activities were reviewed for their relevance to OSS missions, for their potential for using products better supplied by industry or other government agencies, and for recommending an information technology (IT) infusion strategy for appropriate products for OSS missions. Assessment scope and methodology are presented. IT needs and interests for future OSS missions and current NASA IT research and development (R&D) are discussed. Non-NASA participants provide overviews of some of their IT R&D programs. Implementation and infusion issues and the findings and recommendations of the assessment team are presented.

Author

*Aerospace Engineering; Information Systems; Technology Assessment; NASA Programs*

**20020039537** NASA Langley Research Center, Hampton, VA USA

**Biomimetics for NASA Langley Research Center: Year 2000 Report of Findings From a Six-Month Survey**

Siochi, Emilie J., NASA Langley Research Center, USA; Anders, John B., Jr., NASA Langley Research Center, USA; Cox, David E., NASA Langley Research Center, USA; Jegley, Dawn C., NASA Langley Research Center, USA; Fox, Robert L., NASA Langley Research Center, USA; Katzberg, Stephen J., NASA Langley Research Center, USA; February 2002; 95p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 706-32-51-01

Report No.(s): NASA/TM-2002-211445; L-18153; NAS 1.15:211445; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report represents an attempt to see if some of the techniques biological systems use to maximize their efficiency can be applied to the problems NASA faces in aeronautics and space exploration. It includes an internal survey of resources available at NASA Langley Research Center for biomimetics research efforts, an external survey of state of the art in biomimetics covering the Materials, Structures, Aerodynamics, Guidance and Controls areas. The Biomimetics Planning team also included ideas for potential research areas, as well as recommendations on how to implement this new program. This six-month survey was conducted in the second half of 1999.

Author

*Biomimetics; Aeronautical Engineering; Space Exploration; NASA Programs*

**20020039994** Jet Propulsion Lab., Pasadena, CA USA

**Information Technology Assessment Study: Executive Summary**

Peterson, John, Editor, Jet Propulsion Lab., USA; March 2002; 26p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS7-1407

Report No.(s): JPL-Publ-02-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A team was formed to assess NASA Office of Space Science (OSS) information technology research and development activities. These activities were reviewed for their relevance to OSS missions, for their potential for using products better supplied by industry or other government agencies, and for recommending an IT infusion strategy for appropriate products for OSS missions. Assessment scope and methodology and the findings and recommendations of OSS IT users and providers are presented.

Author

*Technology Assessment; Research and Development; Aerospace Engineering; Information Systems; NASA Programs*

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